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Adaptive COPE
Annual Report

October 1, 1988 - September 30, 1989

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Adaptive COPE Program
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THE COASTAL OREGON PRODUCTIVITY ENHANCEMENT (COPE) PROGRAM

Initiated in 1987, the Coastal Oregon Productivity Enhancement (COPE) Program is a cooperative effort between the College of Forestry at Oregon State University (OSU), the USDA Forest Service Pacific Northwest Research Station (PNW),the USDI Bureau of Land Management, other federal and state agencies, forest industry, county governments, and the Oregon Small Woodland Association. The intent of the program is to provide resource managers and the public with information on management of fish, timber, water, wildlife, and other resources of the Oregon Coast Range. To find effective ways to manage these diverse resources collectively, the COPE Program integrates research, education, and scientific disciplines.

The COPE Program has two related components; scientists in both Fundamental COPE and Adaptive COPE focus on problems related to riparian zone management and the regeneration of Oregon Coast Range forests. Fundamental COPE scientists, mainly from OSU and PNW in Corvallis, conduct basic research studies. Adaptive COPE is an interdisciplinary team of OSU College of Forestry scientists. They are responsible for applying and adapting existing research to Oregon Coast Range conditions. Stationed in Newport at the Hatfield Marine Science Center, the Adaptive COPE team is also responsible for facilitating information transfer by providing continuing education opportunities. Adaptive COPE scientists work with county Extension forestry agents to extend the program throughout the 13-county area of the Oregon Coast Range. Basic research under Fundamental COPE is supported by the USDA Forest Service and USDI Bureau of Land Management. The Adaptive COPE program is funded by over 40 different organizations, including federal and state agencies, forest industries, and coastal counties.

COPE ORGANIZATION

Advisory Council

Representatives of COPE Cooperators

Provides advice and guidance on program direction (listing inside back cover).

Dean, College of Forestry

Carl Stoltenberg

Convenes Advisory Council. Makes major decisions on OSU support.

Director, PNW Station

Charles Philpot

Makes major decisions on PNW support.

COPE Program Manager

Stephen Hobbs

Coordinates activities of all organizations involved and provides overall program leadership and administration.

Adaptive COPE

OSU College of Forestry scientists

Conducts adaptive research and facilitates transfer of information.

Fundamental COPE

OSU and PNW scientists

Conducts basic and applied research

Adaptive COPE Staff

Scientists:

Forest Engineering	
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Engineering/Hydrology	Arne Skaugset
Forest Science	
Silviculture	Catherine Bacon
Wildlife	Andrew Hansen

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Eric Horvath
John Donahue
Steven McConnell
Lisa Melton
Jeff Peterson
Ronald Rhew

Secretary

Marcy Berg

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COOPERATORS

Federal Agencies

Bureau of Indian Affairs
Bureau of Land Management
Pacific Northwest Research Station
Siskiyou National Forest
Siuslaw National Forest
U.S. Fish and Wildlife Service

State Agencies

Department of Energy
Department of Fish and Wildlife
Department of Forestry
Department of Land Conservation and Development
Division of State Lands
Oregon State University

Oregon Counties

Benton
Clatsop
Coos
Curry
Douglas
Josephine
Lane
Lincoln
Polk
Tillamook
Washington
Yamhill

Industries

Bohemia, Incorporated
Boise Cascade Corporation
Champion International Corporation
Diamond B Lumber Company
Georgia-Pacific Corporation
Giustina Brothers Lumber and Plywood Company
Howard-Cooper Corporation
Hydraulic & Machine Services, Incorporated
International Paper Company
James River Company
Longview Fibre Company
Papé Brothers, Incorporated
Roseburg Resources Company
Rosboro Lumber Company
RSG Forest Products, Incorporated
Smurfit Newsprint Corporation
Starker Forests, Incorporated
Stimson Lumber Company
Sun Studs, Incorporated
Weyerhaeuser Company
Wheeler Manufacturing Company
Willamette Industries, Incorporated
Willamina Lumber Company

Other

Oregon Small Woodland Association
Oregon Coastal Zone Management Association

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HIGHLIGHTS FOR FISCAL YEAR 1989

During its second year of research and education activities, Adaptive COPE has:

- Continued five research projects and planned six additional studies on active riparian management, slope stability, wildlife, large woody debris in streams, riparian silviculture, and reforestation alternatives.
- Published a major compendium that summarizes all current research and administrative studies in forestry, fisheries, wildlife, soils, and hydrology on federal, state, and private lands in the Oregon Coast Range.
- Published technical and popular articles about the COPE program and technical papers on road culvert design and on winter habitat requirements for coho salmon.
- Published four issues of the COPE Report quarterly newsletter highlighting COPE research and information-transfer activities. Newsletters were distributed to over 1,350 individuals.
- Sponsored workshops on “Forestry and Landslides” (Newport: 240 participants) and “Wildlife Diversity and Landscape Patterns in Northwest Coastal Forests” (Newport: 320 participants).
- Given 35 formal and informal presentations about the COPE program and related technical topics pertaining to resource management.
- Prepared a poster and brochure highlighting COPE research and education efforts.
- Continued to exchange information about the COPE program with cooperators and coastal citizens through field tours, office visits, phone consultations, and news articles.

INTRODUCTION

The COPE program was developed to maintain and enhance the productivity of the diverse forest-based resources in the Oregon Coast Range. Toward achieving that goal, we are increasing our knowledge and awareness of the interrelationship of fish, wildlife, timber, water, and soils in this region, as well as evaluating various ways to manage riparian zones and reforest harvested lands efficiently.

Adaptive COPE plays a multifaceted role within the COPE program. Comprised of an interdisciplinary team of scientists and support staff, Adaptive COPE develops and adapts research information to address specific riparian zone management and reforestation questions. It also has the primary responsibility for providing resource managers with continuing education opportunities via newsletters, workshops, technical publications, field tours, and one-on-one consultations. This role insures that the information developed from COPE research studies is quickly and widely disseminated to resource managers and the general public throughout the Coast Range.[1]

In this second year of the program, research and continuing education programs have expanded. Six new research studies were planned for fiscal year 1990 and five were continued, a comprehensive compendium of current Coast Range research and administrative studies was published, a COPE poster and brochure were developed, and major workshops on landslides and wildlife in coastal forests were held. Currently, Adaptive COPE research and education efforts are focusing on the following management issues: riparian areas; slope stability; wildlife in managed forests; the effects of large woody debris in streams; riparian silviculture; and reforestation alternatives. This report summarizes these activities and the accomplishments.

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[1] For further information about the COPE program, see "A Long-Range Plan for Completing the Coastal Oregon Productivity Enhancement (COPE) Program." Copies can be obtained at the Oregon State University, College of Forestry Business Office, Peavy Hall, Corvallis, Oregon 97331.

RESEARCH

Adaptive COPE scientists started work on five research projects in fiscal year 1989 and planned six new studies for fiscal year 1990. In addition to the descriptions given below, future progress will be highlighted in COPE Report articles, workshops, technical publications, and annual reports.

CONTINUING STUDIES

MODELING ROOT REINFORCEMENT IN SHALLOW FOREST SOILS

(Arne Skaugset and John Donahue–OSU Adaptive COPE; Marvin Pyles–OSU Fundamental COPE)

In the Oregon Coast Range, the combination of steep slopes, shallow soils, and abundant rainfall makes landslides the dominant form of erosion. Research has shown that timber harvesting can accelerate the rate of erosion by increasing landslide frequency. Theoretically, as the roots of harvested trees decay, soil reinforcement declines and soil stability is threatened. This research project was initiated to increase understanding of the mechanism of root reinforcement in shallow forest soils. Among the objectives are developing an analytical model of the root reinforcement mechanism and testing the validity of that model in the laboratory.

To develop such a model, we first needed to describe the reinforcement process in mathematical terms. Therefore, a laterally loaded pile in a flexible foundation was chosen to represent roots reinforcing a forest soil, and the differential equations describing laterally and axially loaded piles would be the governing equations for root reinforcement. In addition to the governing equations, the engineering properties of both the roots and the soil had to be known. For those, we used both unpublished research results and the published literature to determine the values for such properties as Young's modulus of elasticity and the ultimate strength of woody roots, as well as the empirical soil-response curves.

The analytical model is being developed to predict strength increases in two situations. The first situation occurs when loading the reinforcing element creates a linear response. This response can be used to predict strength increases throughout the range of deformation of the reinforcing element; however, it is usually used only for small deformations. The second situation, often associated with large deformations of the reinforcing element, occurs when loading the reinforcing element creates a nonlinear response. For both linear and nonlinear responses of the reinforcing elements, the solutions to the governing differential equations will be determined with finite difference-approximation techniques. For the case involving a linear-reinforcing element response, the finite difference equations

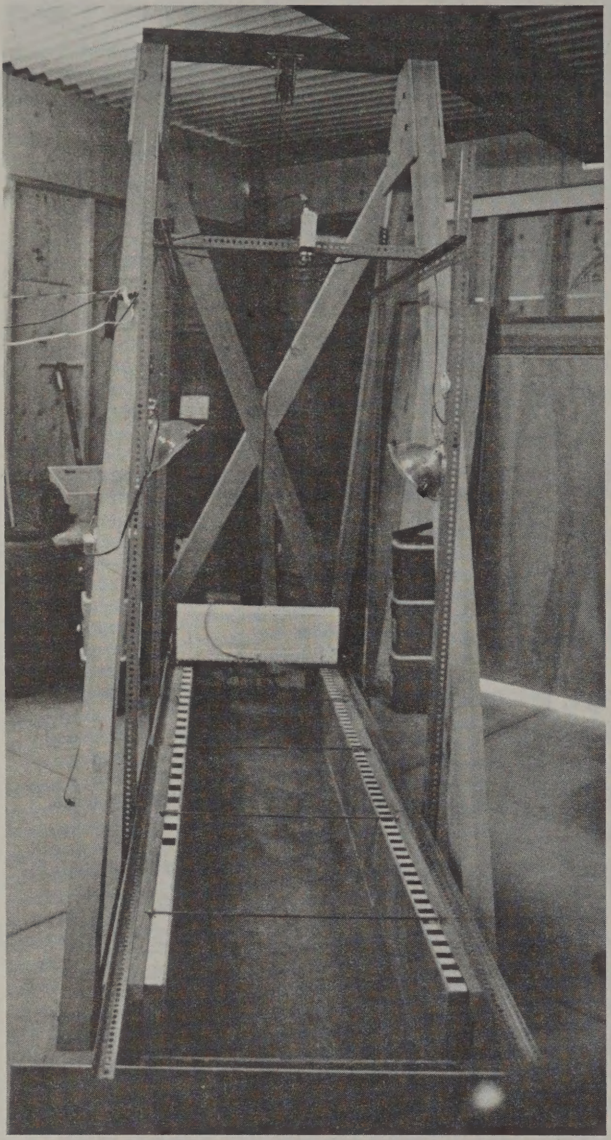

Figure 1. Tilting table used to measure the effects of soil and root strength on a simulated landslide.

have been derived and an algorithm has been developed.

To test the validity of the analytical model, we built a tilting table at the Marine Science Center (Figure 1). The tilting table allows experimental manipulation of soil and root strength, as well as other variables affecting the landslide process. Modeling landslides with a tilting table will involve a soil with known and repeatable strength characteristics and with known amounts and types of reinforcement. Most importantly, the time of failure and the stresses on the failure plane at that time will be known.

An integral part of this phase of the project has been the development of a data acquisition system for the tilting table. Data collection for verifying the analytical model requires measuring deformation of the soil surface on the tilting table during the course of a landslide. Traditional means of measuring soil-surface deformation, such as string potentiometers, are inappropriate for this project because they inadvertently contribute to soil reinforcement. Therefore, considerable time has been spent developing an alternative data-acquisition system for the tilting table. That system uses digital imaging technology to track targets located on the soil surface; a frame grabber in a personal computer can digitize images from a video camera. Thus, this system offers many advantages over other data-collection schemes. However, the most important advantage is that soil-surface deformations can be continuously recorded without interfering with the reinforcement process.

Further details on the conceptual development of the analytical model of root reinforcement were reported in COPE Report 2(2):4-7 and at the COPE workshop "Forestry and Landslides."

LARGE WOODY DEBRIS AND FISH HABITAT IN COAST RANGE STREAMS

(Thomas McMahon and Ronald Rhew–OSU Adaptive COPE; Robert Beschta–OSU Fundamental COPE; Gordon Reeves and James Sedell–PNW Fundamental COPE)

Information and awareness about the key role that large woody debris plays as fish habitat in streams has increased substantially over the past decade. As a result, state and federal agencies now require the retention of standing timber along fish-bearing streams after harvest to insure a continued source of wood. Although the importance of large woody debris as fish habitat is now generally recognized, information about the amount of wood in Coast Range streams and the relationships between debris abundance and fish populations remains incomplete.

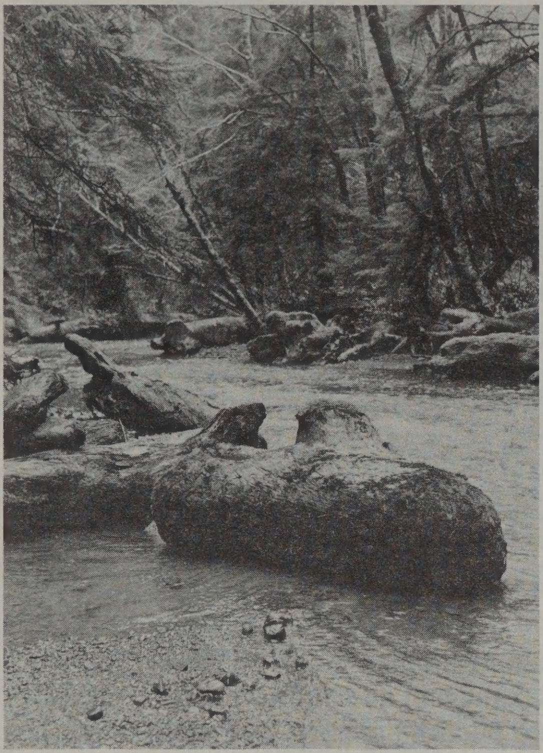
Figure 2. Large woody debris in a Coast Range stream.

As part of this study, current information on abundance and distribution of large woody debris is being synthesized from a wide range of Coast Range streams. This past year, unpublished and published data on large woody debris were consolidated from the Bureau of Land Management, PNW, and OSU files into a common computerized database. At present, such data has been compiled from 90 streams covering over 180 miles of stream length and representing a wide range of stream sizes and management histories. Additional streams were surveyed this summer to add information about stream types where data on large woody debris are lacking (Figure 2). Once compiled, the database will be used to compare characteristics of large woody debris in streams of differing size, order, gradient, and management history. A summary of current debris-loading levels in a wide variety of Coast Range streams should prove useful as a "yardstick" for evaluating changes in debris levels resulting from management activities. Comparisons of amounts and sizes of debris in managed and unmanaged systems should also prove useful for defining streamside management goals for maintaining or increasing appropriate levels and sizes of debris in streams.

Further particulars on this study were reported in COPE Report 2(3):2-4 and in the 1988 Adaptive COPE Annual Report.

WILDLIFE ABUNDANCE AND DIVERSITY IN MANAGED UPLAND FOREST LANDSCAPES

(Andrew Hansen and Jeff Peterson–OSU Adaptive COPE)

The first objective of this study is to determine the associations between wildlife and habitat in three prevalent stand types: managed, open-canopy plantations 2 to 8 years old; managed, closed-canopy plantations 20 to 30 years old; and natural, mature forests. The second objective is to quantify these associations along a gradient from the edge of a stand to the interior. The final objective is to describe landscape-level habitat patterns across the Drift Creek Basin in the central Coast Range.

Although forest management probably strongly influences wildlife diversity, little is known about how individual species in the Oregon Coast Range respond to typical silvicultural practices. This study compares the bird, small mammal, and amphibian communities in natural forests with those in intensively managed plantations (Figure 3). By knowing the stand and microhabitat features needed for each wildlife species, as well as how the species respond to edges, land managers will be able to design the sizes and types of cutting units that optimize timber and wildlife objectives. Moreover, describing habitat patterns over the study area will reveal which habitats and associated wildlife are fragmented or are in short supply.

Figure 3. Brown creepers like the one shown here and other birds and vertebrates are being censused in forest stands of varying ages.

A detailed study plan was prepared and field work initiated during 1989, the first year of the study. Six study sites adjacent to natural, mature forest were selected; three containing open-canopy, managed plantation and three containing closed-canopy plantation. At each site three parallel transects were delineated. The transects lie perpendicular to the forest/plantation edge, extending 260 m into the plantation and 400 m into the forest. Small mammals and amphibians were trapped in pitfalls along the transects during 1-month periods in spring and fall. Birds were censused by sight and sound during winter and spring, and breeding territories were mapped in spring. Habitat measurements were initiated at the study sites in summer.

The data are being analyzed by quantifying associations between wildlife and vegetation at the stand level and the microhabitat level, as a function of distance from the edge of the stand. The results are expected to reveal which wildlife species are associated with each of the three stand types and the microhabitat relationships that explain those associations. Moreover, the study will identify which species, if any, are intolerant of forest edges and likely to be adversely affected by the fragmentation of natural forests. All of this information on wildlife habitat relationships will be used to classify the vegetation across the Drift Creek Basin in order to produce habitat-suitability maps of the watershed.

Field sampling will continue through 1990, with the vegetation mapping, data analyses, and report preparation extending into 1991. An overview of the study was presented in COPE Report 2(1):3-4 and first-year results were reported at annual meetings of the Ecological Society of America, the Society of American Foresters, and at the COPE workshop "Wildlife Diversity and Landscape Patterns in Northwest Coastal Forests."

ESTABLISHMENT AND GROWTH OF CONIFERS IN ALDER-DOMINATED RIPARIAN ZONES

(Catherine Bacon and Steven McConnell–OSU Adaptive COPE)

Although the general consensus is that riparian vegetation should be diverse, with a mix of conifers, hardwoods, snags, and shrubs, past disturbance (e.g. fire and harvesting) has left many Oregon Coast Range riparian areas dominated by red alder stands with dense understories of salmonberry and other shrubs. Natural establishments of conifers in these stands will be greatly delayed, or may never occur. Thus, the possibility of a mixed stand becomes remote.

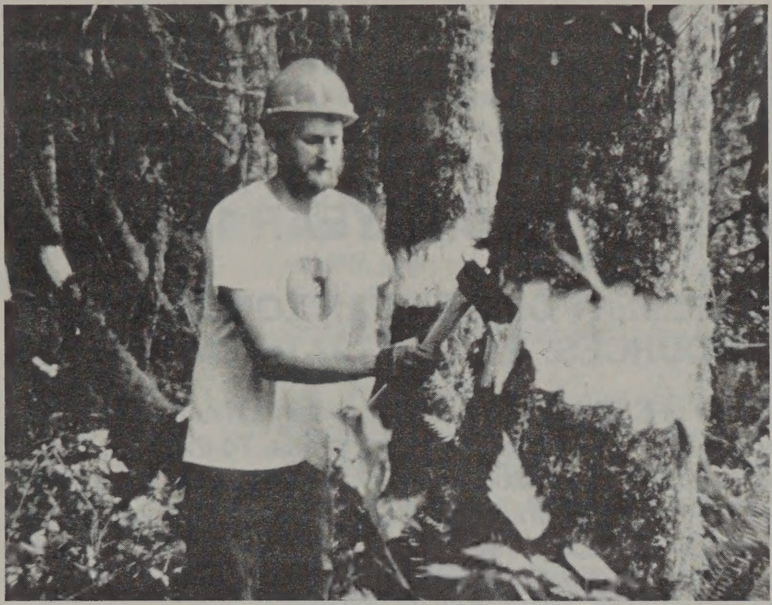
Figure 4. Girdling of overstory alder is one of the silvicultural treatments in the conifer-underplanting study.

The study was started this year to evaluate ways of establishing and growing underplanted conifer seedlings in alder- and brush-dominated riparian zones. Six sites on federal, state, and private lands from Astoria to Gold Beach include six treatments each involving manipulation of the overstory and understory canopies (Figure 4). To cover a range of possibilities, alder treatments involve (1) girdling all trees, (2) girdling half of the trees, or (3) leaving the canopy intact. The understory will be removed from half of each overstory treatment plot. This coming winter, seedlings of Douglas-fir, grand fir, western redcedar, and western hemlock will be planted in each treatment. Half of the seedlings will be protected against animal damage with plastic-mesh, flexible tubing. The seedlings will be measured each year for the duration of the COPE program. Details of the study were reported in COPE Report 2(3):4-5.

A SYNTHESIS OF REFORESTATION PRACTICES WITH CONSTRAINTS ON FIRE AND HERBICIDES

(Catherine Bacon and Steven McConnell–OSU Adaptive COPE)

Faced with increasing restrictions on such traditional vegetation-management methods as slashburning and herbicides, silviculturists are experimenting with alternative ways to remove unwanted vegetation that competes with conifer seedlings. To date, information about these alternative methods and their relative effectiveness has not been summarized. The purpose of this study was to synthesize this information for the Coast Range area. Published information on tests of the alternative methods and previously unpublished information from the land managers who have been using the methods are included. The synthesis report includes a review of traditional Coast Range management, focusing on the intensive regeneration of Douglas-fir. Alternative reforestation methods that will work with the traditional clearcut system are also covered. This includes alternative site-preparation treatments, release treatments, and the use of different planting strategies. Discussion of alternative harvesting systems has been included as well.

An initial review of the literature also indicated that another Adaptive COPE project is needed on this subject of vegetation management and reforestation in coastal forests. This study will evaluate the effects of grass seeding on the growth of Douglas-fir seedlings and the major woody competitors found in the Oregon Coast Range (see p. 11). The draft synthesis manuscript is expected to be published as a technical report next year.

NEW STUDIES PLANNED FOR FISCAL YEAR 1990

ACTIVE MANAGEMENT OF RIPARIAN ZONES FOR MULTIPLE RESOURCES: AN INTEGRATED APPROACH

A major objective of COPE is to find ways to maintain or enhance the productivity of fish, wildlife, and timber in riparian areas. To this end, current Fundamental and Adaptive COPE studies are characterizing existing riparian stands, describing the interactions between riparian habitat and fish and wildlife, and identifying desired tree species and habitat features in riparian areas to increase multiple resources concentrated in and along streams. This study will complement these efforts by developing and testing various strategies for managing and manipulating riparian areas to obtain desired features.

Specifically, the study will identify a series of projects to evaluate the feasibility and success of various methods for protecting and enhancing fish and wildlife habitat and for promoting tree establishment and growth in riparian areas. Studies will focus on evaluating both the effectiveness of current riparian management-area practices as well as methods for manipulating or "actively managing" existing stands. Because effective, integrated management of riparian areas requires information on fish, timber, wildlife, and soils, as well as their response to a particular forest management practice, studies will involve all members of the Adaptive COPE team. Results from individual studies will also be integrated to develop and evaluate various approaches to active management of riparian areas.

Three studies on active riparian management will be coordinated under this study: (I) establishment and growth of conifers in alder-dominated riparian stands (initiated in FY 1989); (2) release of existing understory coniferous trees in alder-dominated riparian zones; and (3) influence of the size of debris pieces on function in small streams.

1. Establishment and growth of conifers in alder-dominated riparian zones

(described on p.6).

2. Release of understory coniferous trees in alder-dominated riparian zones of the Oregon Coast Range

(Catherine Bacon, Thomas McMahon, Steven McConnell, Lisa Melton–OSU Adaptive COPE)

Establishment and growth of coniferous trees in riparian zones have been identified as high priority for riparian zone management in the Oregon

Coast Range for two major reasons: (1) conifers provide large woody debris and snags that improve fish and wildlife habitat, and (2) those species of trees can be a source of harvestable timber.

Presently, many riparian areas in the Coast Range are dominated by red alder rather than conifers because of disturbances in the past. But red alder-dominated stands generally provide less suitable habitat for fish and wildlife than mixed stands. Moreover, red alder does not attain the size, strength, and decay resistance of conifers, making it less desirable as timber and as a source of large woody debris in streams.

Our recent surveys of second-growth riparian zones throughout the Coast Range revealed that a number of suppressed and intermediate conifers exist in the understory of many alder-dominated riparian zones. Many of these are shade-tolerant species that may eventually gain dominance over the site. Some are intolerant species and will eventually die if not released. Tolerant species left to attain dominance on their own will likely do so very slowly. Growth rates of tolerant species may increase by overstory removal (release), shortening the time until they are large enough to be valuable as large woody debris, usable snags, or harvestable trees. Successful release of suppressed conifers has been described in other studies of overstory removal in upland sites, but little is known about conifer responses to this type of thinning in riparian stands.

This study will attempt to determine the tree and stand conditions associated with release of understory conifers. As a result, managers can hopefully assess the suitability and success of release treatments.

3. Influence of woody-debris piece size on function in small streams

(Thomas McMahon and Ronald Rhew–OSU Adaptive COPE; R.Bilby–Weyerhaeuser; James Sedell–PNW Fundamental COPE; M. Clady and S. Woltering–Siuslaw National Forest; R. House–Bureau of Land Management)

State and federal regulations for riparian zone management require the retention of specified amounts of standing timber along important fish-bearing streams after adjacent areas have been harvested. The primary goal of these regulations has been to ensure a continued source of woody debris for streams. Although the importance of wood in streams is generally recognized, the way in which characteristics of the debris, such as size, tree species, or orientation influence the function of this material in streams of varying sizes needs to be studied. The relationship between size of debris and its stability during high flow events also has not been clearly established. A more complete understanding of these interactions would allow matching the type of debris to the needs of a particular stream, so that fish habitat could be maintained while minimizing costs to the landowner.

The purpose of this study is to experimentally evaluate the relationship between debris-piece size and function in small stream systems of the

Oregon Coast Range. Experimental placement of pieces of wood of varying sizes in stream channels will be used in this study to examine the relationship between piece size and function. Changes in channel morphology, sediment accumulation, debris stability, and fish populations at the study sites will be monitored through time. Morphology of the channel at debris placement sites will be carefully mapped before installing the wood and then remapped annually.

STABILITY ASSESSMENT OF END-HAUL DISPOSAL AREAS

(Arne Skaugset and John Donahue–OSU Adaptive COPE; Marvin Pyles–OSU Fundamental COPE; D. Michael, K. Mills, and J. Seward –Oregon Department of Forestry)

Research results indicate that timber harvesting activities can increase landslide frequency on steep, landslide-prone slopes of the Pacific Northwest. Some investigators have shown that roads play an important role in the increased incidence of such landslides. Consequently, management practices have been developed that minimize this problem by reducing the number of roads, avoiding high-risk sites for roads, and improving road construction and maintenance.

Moving waste material generated in road construction from an unstable site—called end-hauling—can also help to minimize road-related landslides. This practice is used whenever roads are constructed on slopes greater than 50 to 70 percent. Often, logging engineers will consider many alternatives, including different logging systems and road locations, before electing to end-haul a section of road.

At times, however, logging roads must be built through high-risk terrain, and end-hauling is required. A significant problem in these cases is locating sites for disposal of the spoil material. Relatively flat, stable sites that are most suitable for end-haul disposal are not abundant in steep, landslide-prone terrain. This problem has never been investigated rigorously, so there are no formal criteria for choosing end-haul disposal areas. The purpose of this project is to develop a set of procedures for siting end-haul disposal areas on a basin scale and for evaluating the relative and/or absolute stability of these selected areas on a site-specific scale.

ADAPTATION OF A FOREST SUCCESSION AND WILDLIFE HABITAT MODEL TO MANAGED COAST RANGE FORESTS

(Andrew Hansen–OSU Adaptive COPE; William McComb and John Tappeiner–OSU Fundamental COPE; Joseph Means and Thomas Spies–PNW Fundamental COPE; D. Urban–University of Virginia)

The interrelationship between forest development and wildlife communities is difficult to study because of the long period of time required for stands to reach maturity. Few studies in the Pacific Northwest, for example, have examined the response of tree seedlings to animal herbivory for more than a few years. Similarly, the dynamics of wildlife in managed forests over the full rotation cycle are poorly known. Simulation models can help. They are widely used to examine long-term forest responses to management practices and natural disturbances.

To be useful, a model for simulating the long-term effects of forest management on wildlife must have several capabilities. First, the model must simulate the growth and development of mixed-species, mixed-age stands, because various trees, shrubs, and herbs comprise important features of wildlife habitat. Second, the model must simulate stand changes over time in terms used to describe habitat suitability for many different wildlife species (e.g., tree height, snag density and composition, canopy cover). Finally, the model should be able to simulate tree and shrub growth under various management and disturbance regimes.

The FORET family of models has these capabilities. They simulate the establishment, growth, and death of individual trees based on species life histories, competition from neighboring plants, and local disturbance regimes. These models have been used previously to simulate forest and habitat response to various thinning regimes, insect and mammal herbivory, and air pollution. Over 20 versions have been developed around the world, including one for the Pacific Northwest (CLIMAX).

In this study, CLIMAX will be adapted for use in plantations and natural stands in the Oregon Coast Range. Expanded consideration of shrubs and snags and a subroutine for classifying wildlife habitats will also be added to the model. The model will be used to predict tree response to browsing and the long-term dynamics of wildlife habitat in managed forests. The model, once in place, will be useful for broader application to problems of riparian zone silviculture, snag and woody-debris dynamics, and landscape-level forest management.

EFFECTS OF FORAGE SEEDING ON ESTABLISHMENT AND GROWTH OF DOUGLAS-FIR SEEDLINGS

(Catherine Bacon and Steven McConnell–OSU Adaptive COPE; Robert Wagner–OSU CRAFTS Program)

Forage seeding of recently burned clearcuts with a grass-legume mix is being encouraged as a method of multiple resource management. Proponents claim that forage seeding increases the nutrition available to big game wildlife (e.g., elk and deer), provides some brush control for planted conifer seedlings, and protects against soil erosion. Several studies have addressed the wildlife nutrition and soil erosion aspects, but there is little information on the effect of introduced grasses and legumes on the establishment and growth of conifers. Previous studies have indicated that herbaceous vegetation reduces the growth of Douglas-fir seedlings, even on moist sites of the Oregon Coast Range. There is some concern, then, that forage seeding will decrease conifer growth.

Also requiring further testing is the hypothesis that establishment of forage-seeded vegetation reduces the invasion and growth of naturally occurring woody and herbaceous competitors. If this is true, then the trade-offs of natural versus introduced vegetation need to be explored by looking at the relative competitive abilities of the grass-legume mix and the natural species. This study will monitor the invasion of natural competitors in seeded and unseeded plots while comparing the survival and growth of Douglas-fir seedlings in these plots.

Finally, some managers include herbaceous weed control in their normal plantation-establishment treatments. Little information exists, however, to indicate when and how often plantations should be treated to achieve maximum conifer growth. This study will examine the conifer-growth response to different frequencies and timings of herbaceous weed control in the first five years after planting.

EDUCATION

To ensure that research information developed with COPE is widely and quickly disseminated and implemented, Adaptive COPE scientists publish scientific papers, reports, and a quarterly newsletter; give formal presentations, symposia, workshops, and field tours; and consult with cooperators. Forestry Extension agents assist in bringing COPE research findings and activities to the attention of the general public via their county Extension newsletters and workshops.

PUBLICATIONS AND REPORTS

Bacon, C. 1989. COPE—Coastal Oregon Productivity Enhancement. P. 86 in Informed decisions: Are you using the latest information and technology? Proceedings of the 79th Western Forestry and Conservation Association annual meeting, Seattle, Washington.

The major focus of COPE research is management of riparian zones and regeneration of Coast Range forests. Research under the regeneration of forests includes studies on vegetation management, as well as site productivity and wildlife concerns. Several studies are included in the vegetation managemen section. One involves a cooperative effort with the CRAFTS program to develop a young-stand growth model. Another study is examining the long-term effects of site preparation and release treatments as stands reach crown closure and precommercial thinning stages. Several studies are exploring the ecology and management of the common shrub and hardwood species of the Coast Range, including the life cycles of plants that can be established from both seeds and sprouts. The effects of timing in the manual control of salmonberry are also being investigated. A major part of the COPE vegetation-management research that is just beginning will focus on evaluating techniques for reforestation with constraints on fire and herbicides.

Bacon, C., A. Hansen, T. McMahon, and A. Skaugset. 1989. Compendium of current Coast Range research. Forest Research Laboratory, Oregon State University. 128 p.

This compendium contains summaries of research and administrative studies being conducted in the Oregon Coast Range in fisheries, forestry, soils, hydrology, and wildlife. Over 200 studies were contributed from 24 organizations, including federal and state agencies, forest industry, and universities. The compendium should be a valuable reference for land managers and scientists interested in learning more about research and management of Coast Range resources.

Dyer, M.I., F. di Castri, and A.J. Hansen. 1988. Geosphere-biosphere observatories: their definition and design for studying global change. Biology International 16:1-39.

This report reviews research and monitoring facilities needed for examining ecological responses to global climate change. A system of geosphere-biosphere observatories is described that ranges from large research areas to small monitoring stations aligned to form continental-scale transects.

Hobbs, S.D., and T.E. McMahon. 1989. COPEing mechanisms. Forest World 5(1):27-29.

This article is a popularized account that reviews: (1) the issues leading to the development of the COPE program, (2) the organizational structure and goals of the cooperative research and education effort, and (3) the early findings from selected studies on riparian-zone management and reforestation in Oregon's Coast Range.

Holtby, L.B., T.E. McMahon, and J.C. Scrivener. 1989. Stream temperatures and inter-annual variability in the emigration timing of coho salmon (Oncorhynchus kisutch) smolts and fry and chum salmon (Oncorhynchus keta) fry from Carnation Creek, British Columbia. Canadian Journal of Fisheries and Aquatic Sciences 46:1396-1405.

Stream temperatures were shown to strongly influence the timing of emergence and downstream migration of coho and chum salmon fry and of seaward migration of coho salmon smolts over a 17-year period. Changes in the timing of migration of fry and smolts may be significant since these fish movements are synchronized with advantageous conditions in the stream and the ocean.

Matter, W.J., R.W. Mannan, E.W. Bianchi, T.E. McMahon, J.H. Menke, and J.C. Tash. 1989. A laboratory approach for studying emigration. Ecology 70:1543-1546.

This paper describes the development and testing of an experimental method for identifying the specific habitat features and social conditions that trigger animals to emigrate or become residents in an area.

McMahon, T.E., and G.F. Hartman. 1989. Influence of cover complexity and current velocity on winter habitat use by juvenile coho salmon (*Oncorhynchus kisutch*). Canadian Journal of Fisheries and Aquatic Sciences 46:1551-1557.

Large woody debris provides a major component of winter cover for young coho salmon, but what characterizes the suitability of such debris has not been clearly defined. This study experimentally examined winter habitat use by coho salmon under varying cover types and flow levels. Cover utilization and the number of fish remaining in artificial stream channels increased significantly as cover complexity increased. Few fish remained in channels during a simulated freshet unless the most complex cover (low velocity, shade, and wood debris combined) was present. Study results emphasize the importance of protecting and/or enhancing the structural complexity of large woody debris for proper management of coho salmon habitat.

Pyles, M.R., A.E. Skaugset, and T. Warhol. 1989. Culvert design and performance on forest roads. *In*: Implementing techniques for successful forest operations. Proceedings, Council of Forest Engineering, Coeur d'Alene, Idaho (in press).

Culvert design requires consideration of hydraulics, hydrology, fisheries, economics, and legal requirements. Surveys of culvert installation in the Coast and Cascade Ranges of Oregon show that a majority of culvert installations have adequate capacity to meet legal and reasonable design standards. However, no common design standard was apparent, and 15 to 25 percent of the culvert installations surveyed appeared unable to meet Oregon Forest Practice Regulations. Further, reduced capacity because of inlet damage or partial plugging affected about half of the culverts surveyed. Care in design should be taken in the future to ensure that culverts remain an available alternative for stream crossings.

Skaugset, A.E., C.G. Bacon, A.J. Hansen, and T.E. McMahon. 1989. COPE research on riparian zone management in the Oregon Coast Range. P. 277-286 *in* Symposium Proceedings on Headwaters Hydrology. W.W. Woessner and D.F. Potts, editors. American Water Resources Association, Bethesda, Maryland.

In Oregon, riparian zone management is a subject of intense concern and interest. This is especially true in the Oregon Coast Range where riparian zones are important for timber production and as habitat for fish and wildlife. This paper describes the COPE program and highlights ongoing riparian research. Included is a description of Fundamental, or "basic," research and Adaptive, or "applied," research. Fundamental COPE research includes riparian vegetation dynamics, wildlife and fisheries interactions within riparian zones, and buffer strips effectiveness. Adaptive COPE research includes conifer establishment in hardwood-dominated riparian zones and the role of large woody debris for fish habitat. These studies will be coordinated in an effort to determine ecological interactions between riparian resources. Adaptive COPE responsibilities also include a strong commitment to communicate the results of COPE research to cooperators, resource managers, and the public through newsletters, workshops, publications, and one-to-one communication.

NEWSLETTER

The COPE Report was mailed quarterly to 1,358 subscribers this year, to acquaint readers with research findings, announce upcoming educational opportunities, and highlight recent publications and topics of interest. The newsletter thus serves to consistently and effectively inform cooperators and other interested persons about COPE activities in particular and resource management issues in general. The four issues of the newsletter published this year are reprinted in the Appendix.

WORKSHOPS

Over the first three years, COPE workshops will emphasize current concepts, research results, and state-of-the-art management practices surrounding the major research and education topics of the COPE Program. These topics are: integrated resource management (FY 1988), landslides (FY 1989), wildlife abundance and diversity in managed forests (FY 1989), management of riparian areas for multiple resources (FY 1990), and reforestation alternatives to fire and herbicides (FY 1990). The workshops on landslides and wildlife conducted this past year proved to be very timely, as shown by a total attendance of 560 participants.

FORESTRY AND LANDSLIDES

March 7 and 8, 1989. Newport, OR. 240 participants.

Twenty speakers representing OSU, the PNW Station, forest industry, and forest management agencies described the history and concerns of landslide research, the geomorphology and mechanisms of landslides, methods for determining high-risk sites, and alternative practices for their mitigation. The audience was composed primarily of field-level resource managers and technical specialists from the timber industry and state and federal resource-management agencies. The turnout was about twice what was expected, reflecting widespread interest in this topic among COPE cooperators. A scoping session held at the end of the workshop was very beneficial for providing directions for future transfer of information on slope stability. (See p. 40 for further details.) A list of workshop speakers and topics is shown below.

DAY ONE

Introductory Comments: A. Skaugset, Adaptive COPE)

Introduction to Landsliding Concerns: Moderator-P. Adams, OSU College of Forestry

The History of Slope Stability Concern and Research in the Oregon Coast Range: G. Ice, National Council for Air and Stream Improvement (NCASI)

Landslide Effects on Fisheries and Aquatic Habitat: F. Everest, Pacific Northwest Forest & Range Experiment Station (PNW)

Regulatory, Water Quality, and Landowner Liabilities Regarding Landslides: G. Brown, OSU College of Forestry

Geomorphic Processes and Mechanics of Landslides: Moderator-G. Ice, NCASI

Headwall Geomorphology in Steep Coast Range Terrain: W. Dietrich, University of California, Berkeley

Failure Processes in Shallow Forest Soils: K. Mills, Oregon Dept. Forestry

Soil Strength in Shallow Forest Soils: W.L. Schroeder, OSU College of Engineering

The Mechanics of Root Reinforcement: A. Skaugset, Adaptive COPE

The Role of Precipitation and Groundwater in Landsliding Processes: R. Beschta, OSU College of Forestry

Slope Stability Model Synthesis and Analysis: M. Pyles, OSU College of Forestry

DAY TWO

Methodologies for Determining Sites with High Landsliding Potential: Moderator-P. Adams, OSU

ODF Procedure for Identifying High-Risk Areas and Sites: D. Michael, Oregon Dept. Forestry

Using LISA for Planning and for High-Risk Site Identification: J. Richeson, Bureau of Land Management

Weyerhaeuser Terrain Analysis Methodology: J. Ward, Weyerhaeuser Corp.

Siuslaw National Forest's Headwall Checklist: M. Hagemann, U.S. Forest Service

The Use and Effectiveness of Alternative Practices to Mitigate Landsliding: Moderator-A. Skaugset, Adaptive COPE

Headwall Leave-Area Effectiveness: H. Froehlich, OSU College of Forestry

Road Location and Design Research: J. Balcom, OSU College of Forestry

Road Location and Logging Plan Integration in High-Risk Terrain: E. Aulerich, Forest Engineering, Inc.

Case Study: Road Location and Design in Unstable Terrain: S. Duncan, Weyerhaeuser Corp.

Road Design and Construction in High-Risk Terrain: R. Sheppard, Boise Cascade

End-Haul Disposal Areas: Problems and Opportunities: K. Mills, Oregon Dept. Forestry

Road Drainage Design and Maintenance in High-Risk Terrain: G. Miller, Champion International Corp.

WILDLIFE DIVERSITY AND LANDSCAPE PATTERNS IN NORTHWEST COASTAL FORESTS

September 14 and 15, 1989. Newport, OR. 320 participants.

This workshop involved an exchange of information among forest managers and researchers on the current concepts and approaches for maintaining wildlife diversity in managed forests. Twenty-six speakers reviewed the links between wildlife diversity and habitat patterns in natural and managed forests, as well as evaluated various management strategies for optimizing habitat diversity and timber production. Over 320 representatives of government agencies, educational institutions, industry, and environmental groups participated in the symposium.

At the conclusion of the workshop, several key questions were addressed. The topics were (1) maintaining viable populations of native wildlife under present timber harvest levels, and designing managed plantations to provide habitat for sensitive species; (2) specific objectives of a "new forestry"; (3) subjecting new management methods to stringent, scientific scruitiny; and (4) the best procedures to deal with management issues that cross ownership boundaries. More information on this workshop will appear in a future COPE Report. A list of workshop speakers and topics is shown below.

DAY ONE

Workshop Background and Objectives: A. Hansen, Adaptive COPE

Integrating Timber and Wildlife Management In the PNW: Challenges and Opportunities: J. Franklin, Pacific Northwest Research Station

Incentives for Managing Biodiversity: L. Irwin, National Council on Air and Stream Improvement

Implications of Landscape Concepts for the Management of Biodiversity: R. Noss, Environmental Protection Agency

Landscape and Wildlife Patterns In PNW Coastal Forests: Moderator-R. Anthony, OSU

Vegetation Patterns In Natural and Managed Forests: T. Spies, Pacific Northwest Research Station

Wildlife Response to Within-Stand Patterns: J. Peterson & A. Hansen, Adaptive COPE

Wildlife Response to Stand Type: B. Noon, Pacific Southwest Research Station and M. Raphael, Rocky Mountain Research Station

Riparian Zones as Habitat and Movement Corridors: W. McComb, OSU

Wildlife Response to Landscape Features: A. Hansen, Adaptive COPE

Regional Patterns of Wildlife Abundance In Pacific Northwest Forests: K. Aubry, Pacific Northwest Research Station

Case Studies: Integrating Timber and Wildlife Management In the Real World: Moderator-B. Noon, Pacific Southwest Research Station

Drain Resource Area, Roseburg BLM District: L. Hayes, Bureau of Land Management

Tillamook State Forest: M. Labhart, Oregon Dept. Forestry and D. Taylor, Oregon Dept. of Fish & Wildlife

Private Lands-Weyerhaeuser: J. Rochelle, Weyerhaeuser

Alsea District, Siuslaw National Forest: M. daLuz, U.S. Forest Service

Blue River District, Willamette National Forest: V. Puleo a K. Geary, U.S. Forest Service

DAY TWO

Strategies for Maintaining Wildlife Diversity In Managed Forests: Moderator-T. Spies, Pacific Northwest Research Station

Three Alternative Timber Harvest Patterns: Staggered Setting, Minimum Fragmentation, Long-Rotation Islands: M. Hemstrom, Willamette National Forest

Management of Plantation Structure and Composition: B. Marcot, Mt. Hood National Forest

Implications of Three Alternative Cutting Patterns for Wildlife Diversity In the PNW: J. Lehmkuhl, Pacific Northwest Research Station

Implications of Three Alternative Cutting Patterns for Other Resources: Forest Regeneration and Wood Production: D. Hibbs, OSU

Implications of Three Alternative Cutting Patterns for Other Resources: Hydrology, Erosion and Fisheries: G. Grant and F. Swanson, Pacific Northwest Research Station; S. Gregory, OSU

Panel Discussion: Trade-offs of Alternative Management Strategies: Moderator-W. McComb; Discussants-J. Franklin, PNW; M. Greenup, USFS; J. Lint, BLM; B. Marcot, USFS; K. Munson, International Paper; J. Rochelle, Weyerhaeuser; M. Newton, OSU

Workshop Synthesis and Future Prospects: L. Norris, OSU

PRESENTATIONS

During the past year, Adaptive COPE scientists made several formal presentations about their research and information-transfer activities to a wide cross section of audiences throughout the Coast Range and the Northwest, including:

> Bureau of Land Management personnel from the Roseburg district office; coastal city managers at their annual meeting in Newport; COPE Advisory Council members at fall and spring meetings; representatives of the forest industry at a COPE meeting in Corvallis; fish and wildlife biologists from the Oregon Department of Fish and Wildlife, Bureau of Land Management, and Forest Service at their annual coordination meeting; members of the OSU Forestry Extension staff; members of the Tillamook chapter of the Society of American Foresters; Jay Cravens, president of the Society of American Foresters; members of the Western Forestry and Conservation Association at their annual meeting; members of the Coquille River Community Advisory Council at their monthly meeting.

A number of informal meetings to discuss COPE activities were also held with representatives from the following groups:

> Bureau of Land Management-Coos Bay; Oregon Department of Forestry, Oregon Department of Fish and Wildlife, and COPE (joint meeting); Oregon Department of Fish and Wildlife–Coos Bay; Siuslaw Timber Operators Association.

In addition, Adaptive COPE staff gave the following technical presentations:

Bacon, C. September, 1989. Riparian silviculture - active riparian management for multiple resources. Society of American Foresters national convention, Spokane, Washington.

Delong, M., R. Rhew, and M. Brusven. June, 1989. Classification and spatial mapping of riparian habitat with applications to modeling instream impacts of agricultural nonpoint source pollution. 1989 Headwaters Hydrology Symposium, Missoula, Montana.

Hansen, A., and D. Urban. December, 1988. Species diversity across landscape and biome boundaries. SCOPE workshop on "Landscape Boundaries: Consequences for Biodiversity and Ecological Flows," Paris, France.

Hansen, A. February, 1989. Landscape ecology and resource management. Annual meeting, Oregon Chapter American Fisheries Society, Bend, Oregon.

Hansen, A., K. Purcell, and B. Noon. February and March, 1989. Does habitat heterogeneity matter to breeding birds in Douglas-fir forests? Oregon and Washington Chapters, Wildlife Society annual meeting, Hood River, OR, and poster presented at Old-Growth Wildlife Habitat Symposium, Portland, Oregon.

Hansen, A. May, 1989. Implications of landscape ecology for wildlife management. Wildlife habitat relationships class, OSU Department of Fisheries and Wildlife and "Managing Plantation Structure" OSU College of Forestry short course, Corvallis, Oregon.

Hansen, A. August, 1989. Modeling vertebrates and habitat across forest edges in the Pacific Northwest: preliminary thoughts. International Society of Environmental Modeling Symposium, Ecological Society of America annual meeting, Toronto, Canada.

Hansen, A. September, 1989. Wildlife response to landscape features. COPE workshop: Wildlife Diversity and Landscape Patterns in Northwest Coastal Forests, Newport, Oregon.

Hansen, A., and J. Peterson. August, 1989. Responses of vertebrates to forest ecotones in the Oregon Coast Range. Ecological Society of America annual meeting, Toronto, Canada.

McComb, W., A. Hansen, and K. McGarigal. September, 1989. COPEing with forest fragmentation in the Oregon Coast Range. Society of American Foresters annual meeting, Spokane, Washington.

McMahon, T. May, 1989. Fish and streams in old-growth forests. Presented at Oregon Forestry Education Teachers Workshop on Old-Growth Forests, Newport, Oregon.

McMahon, T. February, 1989. Winter ecology of juvenile salmon. Marine Fisheries class, Hatfield Marine Science Center, Newport, Oregon.

McMahon, T. February and May, 1989. Behavior, habitat use, and movements of coho salmon smolts during seaward migration: the role of wood. Annual meeting, Oregon Chapter American Fisheries Society, Bend, OR, and Pacific Estuarine Research Society annual meeting, Astoria, Oregon.

Melton, L.L., and S.W. Childs. November, 1988. High soil moisture content ameliorates the impact of frost on Douglas-fir seedlings. Annual meeting, Soil Science Society of America, Anaheim, California.

Melton, L.L. May, 1989. Cold soils and seedling survival. FIR workshop: Reforestation of high elevation sites in southwest Oregon and northern California, Medford, Oregon.

Melton, L.L. October, 1989. Effect of frost on high elevation site seedling survival in southwest Oregon. Hatfield Marine Science Center seminar, Newport, Oregon.

Melton, L.L. January, 1989. Microclimate vs. macroclimate: the balance of power. Hatfield Marine Science Center seminar, Newport, Oregon.

Peterson, J., and A. Hansen. September, 1989. Wildlife response to within stand patterns. COPE workshop: Wildlife Diversity and Landscape Patterns in Northwest Coastal Forests, Newport, Oregon.

Rhew, R. February, 1989. Agricultural contribution of nonpoint source pollution to a small prairie watershed. Annual meeting, Oregon Chapter American Fisheries Society, Bend, Oregon.

Skaugset, A. March, 1989. The mechanics of root reinforcement. COPE workshop: Forestry and Landslides in the Oregon Coast Range, Newport, Oregon.

Skaugset, A.E., C.G. Bacon, A.J. Hansen, and T.E. McMahon. June, 1989. COPE research on riparian zone management in the Oregon Coast Range. Headwaters Hydrology Symposium, Missoula, Montana.

FIELD TOURS

The Adaptive COPE team visited many COPE cooperators the first year of the program, and this year additional formal field tours were made with the following groups:

BLM-Roseburg and Eugene Districts; Champion International; Depoe Bay Watershed Coordinated Resource Management Project; Elliot State Forest; FIR Program, Medford; Georgia-Pacific Corporation; International Paper Company; Oregon Department of Forestry geotechnical specialists; Oregon Department of Forestry-Tillamook and Astoria offices; Siskiyou National Forest; Siuslaw National Forest; Sun Studs, Inc.; Weyerhaeuser; Willamette Industries.

COPE POSTER AND BROCHURE

A four-panel poster and a brochure outlining the objectives of the COPE program, research and technology transfer efforts, and summarizing some of the early research findings from COPE were developed this past year with financial and technical assistance from the Pacific Northwest Research Station. The COPE poster was displayed at the following meetings: American Fisheries Society annual meeting, Anchorage, Alaska; American Water Resources Association Headwaters Hydrology Symposium, Missoula, Montana; and Society of American Foresters annual meeting, Spokane, Washington. Both the poster and brochure will aid greatly in increasing awareness of the COPE program throughout the Coast Range and elsewhere in the Pacific Northwest. The brochure, especially, will serve as a handy information tool about COPE for cooperators and the general public alike.

NEWS ARTICLES

News releases announcing the wildlife workshop and describing the COPE program were prepared by the Adaptive staff and distributed to newspapers in the Coast Range. Reporters attended the landslide and wildlife workshops, and several news articles describing topics discussed at these workshops were published in Coast Range newspapers.

CONSULTATION

An important consideration in the location of the Adaptive COPE Program has been to increase the accessibility of team members to cooperators. Stationed in Newport, staff members have ready contact with resource managers. These informal contacts are a particularly important and effective way of exchanging information. Throughout this second year, individual team members have participated in many informal discussions, field trips, and impromptu meetings. These informal contacts will continue to be a significant part of the Adaptive COPE goal of facilitating the transfer of information among researchers, managers, and the general public.

ORGANIZATIONAL ACTIVITIES

The Adaptive COPE team was involved in a number of committees formed to address various aspects of the COPE program and resource management topics. These assignments included:

- Area Planning Committee for the Shasta Costa watershed, Siskiyou National Forest—Program to provide technical advice for incorporating wildlife habitat into a landscape-level forest plan.
- Basin Selection Committee—Development of selection criteria and identification of study basins where COPE research will be focused.
- Coordination Committee—Coordination among COPE research studies and technology-transfer activities; forum for discussion of COPE technical issues.
- Integration Committee—Coordination and integration of COPE basin research studies.
- Wetlands Technical Advisory Committee, Oregon Department of Forestry—Development of criteria for identification and monitoring of wetlands under the State Forest Practices Act.

PLANS FOR FY 1990

RESEARCH

- Continue studies listed on pages 3-8.
- Initiate studies listed on pages 8-12.

EDUCATION

- Publish four newsletters
- Conduct three workshops: Silvicultural Management of Riparian Areas, Reforestation with Constraints on Fire and Herbicides, and COPE Research in the Drift Creek Basin: A Field Workshop.
- Continue consultations, field trips, and meetings with cooperators.
- Continue to increase public awareness of COPE program.
- Prepare an annual report.

BUDGET SUMMARY FY 1989

Approximate Expenditures	
Personnel	$ 341,540
Services and Supplies	34,569
Travel	29,058
Equipment	17,947
Indirect Costs	15,886
Total	$ 439,000

Revenue Sources	
Federal Agencies	$ 150,000
State Agencies	50,000
Industry	105,000
Counties	27,900
Carryover	133,157
Total	$ 466,057

ANTICIPATED BUDGET FY 1990

Approximate Expenditures	
Personnel	$ 368,000
Services and Supplies	40,000
Travel	45,000
Equipment	24,000
Indirect Costs	23,000
Total	$ 500,000

Revenue Sources	
Federal Agencies	$ 244,000
State Agencies	65,000
Industry	150,000
Counties	38,000
Other	1,000
Carryover	27,057
Total	$ 525,057

APPENDIX

COPE Reports

Quarterly newsletter highlighting COPE research activities, upcoming educational opportunities, and recent publications and topics of interest.

COPE Report

Coastal Oregon Productivity Enhancement Program

Promoting Integrated Management of Oregon's Coast Range Forests
Through Research and Education

Volume 1, Number 4 Fall 1988

The COPE Program

The Coastal Oregon Productivity Enhancement (COPE) Program is a cooperative effort between Oregon State University's (OSU) College of Forestry, the USDA Forest Service Pacific Northwest Research Station (PNW), the Bureau of Land Management (BLM), other federal and state agencies, forest industry, county governments, and the Oregon Small Woodland Association. The intent of the program is to provide resource managers and the public with information relative to the issues and opportunities associated with the management of fish, timber, water, wildlife, and other resources of the Oregon Coast Range. The COPE Program emphasizes an integrated approach—an integration of research and education and an integration of scientific disciplines—to find effective ways to manage these diverse resources collectively.

The COPE Program has two related components: Fundamental COPE and Adaptive COPE. Comprised of OSU and PNW scientists based primarily in Corvallis, Fundamental COPE addresses problems related to riparian zone management and reforestation in the Coast Range through basic research. Adaptive COPE is comprised of an interdisciplinary team responsible for applying and adapting existing research information to solve specific management problems. Stationed on the coast in Newport at the Hatfield Marine Science Center, the Adaptive COPE team is also responsible for providing continuing education opportunities to facilitate technology transfer.

Published quarterly, the COPE Report provides a means to rapidly disseminate research findings, announce upcoming educational opportunities, and highlight recent publications and topics of interest. Its goal is to foster good resource management by helping people involved in the management of Oregon Coast Range resources to stay well-informed. Comments and suggestions concerning the content of the COPE Report are welcomed and encouraged. To receive this free newsletter, contact COPE, Hatfield Marine Science Center, Oregon State University, Newport, OR 97365. Phone: (503) 867-4011.

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Oregon State University

ADAPTIVE COPE

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For specifics on the overall COPE Program, contact Steve Hobbs, COPE Program Leader, Forestry Sciences Laboratory, 3200 Jefferson Way, Corvallis, OR 97331. Phone: (503) 757-4402.

Readers are encouraged to contact authors directly for more detailed information regarding newsletter articles.

ADAPTIVE COPE

RESEARCH COMPENDIUM REPORT AVAILABLE SOON

A draft of the Compendium of Current Coast Range Research is now complete. The compendium has over 200 entries of research and administrative studies in the four major categories of fisheries, forestry, soils and hydrology, and wildlife. The studies summarize the wide range of current research and administrative studies conducted by the various federal, state, university, and private organizations throughout the 13-county COPE area.

Detailed information for each study includes its location, objectives, description, status, contact person, and responsible organization. Topics included within the fisheries category are aquatic ecology, coastal fish stock studies, general fish-habitat relationships, habitat restoration, and population and habitat inventories. The extensive forestry section includes studies in animal damage, disease, economics, growth and yield, harvesting methods, intermediate treatments, long-term site productivity, planting strategies, riparian zone management, seedling quality, site preparation, tree improvement, and vegetation management. While the soils and hydrology section focuses on management effects (e.g. effect of roads on accelerated erosion, logging effects on surface erosion and landslides, and effects of prescribed burning), it also includes studies on aquatic habitat, stream temperature, and general hydrology. The topics in the wildlife section range from control of pest species to the status of indicator or endangered species. It also includes community diversity and habitat management in both riparian areas and upland forests.

The compendium should be available in final form within the next several months. We feel it will be an excellent reference, helping resource managers and researchers get a better idea of what research is being conducted in the Oregon Coast Range. We would like to express our appreciation to those who took the time to respond to our request for information. The compendium could never have been completed without this valuable help. Watch for the announcement of its publication in the Recent Publications section of the COPE Report.

CB

REVIEW OF FIRST COPE WORKSHOP ON INTEGRATED RESOURCE MANAGEMENT

The first Adaptive COPE workshop, "Integrated Resource Management in the Oregon Coast Range: Concepts and Applications," was presented at three locations along the coast (Newport, Coos Bay, and Astoria) in early September (Sept. 9, 13, and 16). The workshop was divided into three sessions. The opening session introduced the COPE program, with presentations on its history, objectives, and organization (S. Hobbs, COPE Program Leader), research projects (T. McMahon, Adaptive COPE), and information transfer activities (C. Bacon, Adaptive COPE). This was followed by a question and answer period where the participants voiced their opinions about the objectives and activities of the COPE program.

The second session concentrated on integrated resource management. It included presentations by Fundamental COPE scientists on ecological linkages within basins (F. Swanson, PNW Research Station and S. Gregory, OSU Department of Fisheries and Wildlife), riparian zone ecology and management (J. Sedell and G. Reeves, PNW Research Station), and on economic, social, and political trade-offs (C. Schallau, PNW Research Station). Also included were talks by Adaptive COPE scientists on the relationship between timber management and slope stability (A. Skaugset) and the integration of timber and wildlife management (A. Hansen).

The final session, entitled "Striving Towards Solutions," included presentations on current land management approaches from a public manager's perspective, by Tom Thompson, Supervisor of the Siuslaw National Forest, and from a private landowner's perspective, by Barte Starker, Executive Vice President of Starker Forests. Participants then broke into small groups to discuss the COPE program and integrated resource management.

A total of 145 participants attended the workshops. Most attendees were land managers from throughout the Oregon coastal region, but Washington, California, and British Columbia were also represented. By design, audience participation was an important part of this first COPE workshop. The major topics of discussion focused on COPE's goals for overall research and technology transfer and on identifying additional information for integrated resource management.

Key comments and questions were:

COPE Information Transfer

- Pertinent past and present research findings from the Coast Range and other areas should be summarized and made available to managers.

- Technical workshops that have varied formats (e.g., lecture, discussion, field) are desirable.

- Alternative educational tools including use of videos, presentations to schools, field demonstrations, and news releases are useful and should be developed by COPE.

- Communication of research findings to policy makers and legislators is important.

- Consult professional adult educators to insure that the information transfer program will be effective.

- The COPE newsletter is informative and useful.

- COPE should continue to actively encourage environmental groups to participate in the program.

COPE Research

- What type of information will COPE provide managers that might not have become available from existing programs?

- Recognizing the variability that exists across the Coast Range, how will the intensive study of three or four focal basins help us in extrapolating concepts and findings to other areas?

- Many of the COPE research topics are very valuable including: road construction and slope stability; active riparian zone management; development and testing of alternative reforestation tools; wildlife community approach.

- Increased research emphasis should be placed on: riparian zones in agricultural lands; effect of forest management on water quality; long-term site productivity and cumulative impacts; animal damage to trees; defining the role of unique wildlife species.

- The present approach of identifying the economic and ecological trade-offs of alternative forest management strategies is attractive.

- COPE should evaluate the effectiveness of current regulatory strategies and rules.

The formal workshop presentations and these comments from the audience generated considerable discussion. As a result, COPE personnel and cooperators now have a better understanding of the goals, expectations, and opportunities for the program. In this regard, the first COPE workshop was a considerable success.

Please contact us at the Adaptive COPE office if you would like a copy of the workshop notebook. It provides a useful summary of each presentation.

AH and CB

ANNUAL REPORT

Copies of Adaptive COPE's first annual report are now available. This report summarizes research and education activities and accomplishments for fiscal year 1988 and lists our plans for 1989. For a copy, please write or phone the Adaptive COPE office.

TM

FUNDAMENTAL COPE

ECOLOGY AND MANAGEMENT OF SHRUBS AND HARDWOODS IN OREGON'S COAST RANGE FORESTS

Currently, foresters manage nonconiferous vegetation in the Coast Range to enhance conifer growth and to provide wildlife habitat. Yet, there is relatively little information on the reproduction and growth habits of many of the important shrubs and hardwoods. Some key questions in the management of these species are: At what stage of succession do various shrub and hardwood species become established? What environments favor their establishment and what are their responses to burning and other silvicultural treatments? How does interspecific competition affect succession and species composition?

This Fundamental COPE project will address these questions by focusing on the important hardwoods: red alder and bigleaf maple; and shrubs: salmonberry, salal, vine maple, ocean spray, and elderberry. Studies are currently underway to determine the rates of germination, seedling survival, and growth rates of both seedlings and vegetative reproduction of these species. These studies will be conducted in clearcuts and thinned and unthinned 40 to 60 year old conifer stands, in order to learn the stage(s) of forest succession during which these species become established and to determine how establishment and growth of these hardwoods and shrubs are affected by stand density. In addition, we are examining the growth and structure of stands of salmonberry and thimbleberry to determine their rates of growth and to test the hypothesis that these species, if untreated, may form stable, pure stands, which inhibit reproduction of tree species.

Early results

First year results from our COPE studies, and other data, indicate that Oregon Coast Range shrub and hardwood species have significantly different requirements for establishment by seed. For example, salal and ocean spray germinated well (70% +) in both clearcuts and young, unthinned conifer stands; however, survival occurred only in young stands, while elderberry germinated and survived only in clearcuts. However, in thinned stands germination (70% +) and early survival (20%-30% +) of all species, including alder and elderberry, appear to be high. Salmonberry germination and early survival was high in clearcuts as well as thinned and unthinned stands. Vine maple apparently has very low rates of germination (1%-3%) and germination of a seed lot occurs for at least two years. Bigleaf maple germinates readily (60% +) the first year. Thus the potential for establishing an understory of these species is markedly different. After seedling establishment, growth of bigleaf maple is quite slow, however, due to browsing and low light. If there is no disturbance to the overstory, it appears that bigleaf maple seedlings will not survive beyond about 20 to 30 years of age in the understory of young conifer stands.

Work on salmonberry suggests that red alder stands provide an ideal environment for the development of salmonberry clones. The average rhizome length per clone in alder stands is over 15 m, while in conifer stands it is only about 5 m. The rhizome bud bank in alder stands is about 600-700/clone, in conifer stands 100-200/clone. Our forthcoming manuscript on salmonberry clone and stand structure will show that rhizome length and, consequently, bud number can be estimated from regression equations using overstory basal area and numbers of salmonberry stems/m^2. Also, our results show that salmonberry stands annually produce new stems above ground, new rhizomes below ground — thus there is an annual recruitment of new clonal individuals which offsets mortality and enables this species to maintain a dense cover. Since tree and large shrub reproduction usually does not occur beneath a cover of salmonberry, it appears that salmonberry stands may be quite stable, both in the understory of conifer and hardwood stands and in the open.

Future work

With future studies, we plan to document the effects of logging and burning on the recovery of salmonberry stands of known rhizome and above-ground density. Also, we are designing studies to assess the presence of salmonberry seed banks. Our preliminary results suggest that by establishing a series of 2' X 2' plots, removing the forest floor from them, and observing when and where salmonberry germinates, the presence of a salmonberry seed bank can be assessed and used to predict the need to control salmonberry during plantation establishment. We will also conduct similar studies on the development and stability of salal. Improved information on the ecology and management of shrubs and hardwoods will help foresters increase their ability to formulate site-specific prescriptions to enhance conifer growth and to produce desired patterns of wildlife habitat.

John Tappeiner,
OSU Forest Management Department
John Zasada, PNW

CHARACTERIZATION OF THE DUFF AND SOIL THERMAL ENVIRONMENT DURING BROADCAST BURNS IN COASTAL FORESTS OF OREGON

Prescribed burning is the skillful application of fire under specific fuel moisture and meteorological conditions to achieve silvicultural and site preparation objectives. This valuable silvicultural tool is used annually to prepare thousands of acres of logged units in the Oregon Coast Range. During the past several years, the Fire and Air Resource Management Project of the Pacific Northwest Research Station has been working to provide a better prescribed burn information system. This will improve the use of fire in meeting forest management objectives while simultaneously reducing negative impacts on air quality.

One of the most important uses of prescribed fire in the Coast Range is for controlling shrub and hardwood species. Currently, there are no predictive equations for estimating the penetration of heat into the organic layer (duff) and mineral soil, or for relating heat penetration to vegetative response. The purpose of this study is to characterize and model the soil thermal environment during burning—a critical step in the development of guidelines for optimum use of fire in achieving both shrub management objectives and in meeting smoke management regulation requirements. The heat-transfer data and the development of a predictive model of heat penetration in this project will be combined with results from a companion COPE study (see previous article) that investigates vegetative reproduction and growth rates of shrubs and hardwood species following prescribed fire.

A pilot study was initiated in 1987 to develop techniques for measuring temperature duration and depth of heat penetration into the humus and mineral soil. Cooperation with the Missoula Fire Lab has led to the selection of the Aston/Gill heat-transfer model (Aston and Gill 1987), which will be adapted to prescribed burning applications. Major input variables to the model are woody fuel and duff consumption, duff and mineral soil fuel moisture, and soil texture. In this study, moisture content, fuel consumption, and heat penetration during prescribed burning will be monitored in field trials to modify and validate the heat penetration model.

Study Methods

Two-acre areas within three cable-yarded clearcut units on the Hebo Ranger District of the Siuslaw National Forest were selected as study sites. Within each study site, 12 permanent plots were established for measuring woody fuel consumption, duff consumption, and heat duration and penetration. Consumption of the small fuels (dead, woody material 0 to 3 inches in diameter) was determined from a pre- and post-burn fuel inventory along permanent transect lines. Consumption of large fuels (dead, woody material 3 to 9 inches in diameter) was measured as the diameter and volume reduction from 20 randomly chosen logs. These logs intersected fuel-inventory transect lines established at each of the 12 permanent plots. Duff consumption was measured by the use of 16 tile duff pins that were inserted flush with the duff layer around each permanent plot. Percent moisture contents for woody fuels, duff, and mineral soil were determined from 50 samples collected before each burn. Ten soil samples were collected to determine soil texture prior to the burn.

Measurement of heat penetration into the duff and mineral soil was obtained by painting each duff tile with a temperature sensitive paint. The temperature of 60°C was monitored with this technique; additional temperature- sensitive paints will be used at future study sites.

Temperature at various soil depths was also measured during actual burning by use of a very small 3-channel thermologger installed at each of the 12 permanent plots. High temperature thermocouple sensors were positioned at three depths in the duff and mineral soil profile (Figure 1).

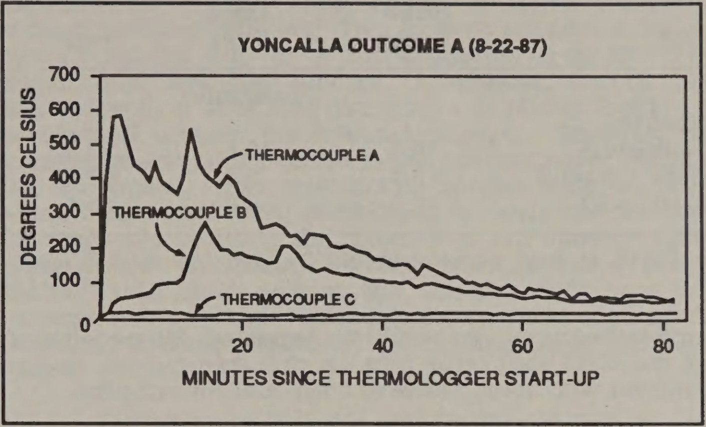

Figure 1. Temperature profile plotted against time at the surface (thermocouple A), 0.2 inch below the surface (thermocouple B), and 1.4 inches below the surface (thermocouple C).

Findings So Far

Although the total woody fuel loading and duff depths were similar between study sites (Table 1), fuel consumption varied because of fuel moisture differences (Table 2). The reduction of large woody fuels and duff on the Yoncalla Outcome-A and Conklin-3D units were predicted reasonably well by fuel consumption models developed by the Pacific Northwest Research Station. These models are currently available in nomogram and user-friendly computer format and are being used extensively by forest managers in the Pacific Northwest (Sandberg and Ottmar 1983; Ottmar et al. 1985). The large woody fuel diameter reduction was over-predicted by the model for the Slick Corner-B unit because the small fuels were very wet and complete ignition of the large fuels did not occur.

The average heat pulse through the forest floor was generally limited because of the wet lower duff layer

Table 1. Unit and fuel data summary for heat penetration study units.

Unit	Forest	Species	Preburn fuels: Small fuels	Preburn fuels: Large fuels	Preburn fuels: Total	Preburn fuels: Duff	Moisture: Large fuels	Moisture: Upper duff	Moisture: Lower duff	Moisture: Mineral soil	Duff dry layer depth	Soil texture
			tons/acre			inches	percent				inches	
Yoncalla												
Outcome-A	Siuslaw	DF/H	16.6	27.6	44.2	2.4	33	34	383	—	0.4	Clay loam
Slick corner-B	Siuslaw	DF/H	21.8	18.3	40.1	2.8	36	35	321	—	0.4	Clay loam
Conklin-3D	Siuslaw	DF/H	17.4	26.9	44.3	2.6	38	16	311	151	0.7	Clay loam

Table 2. Fuel consumption summary for heat penetration study.

	Woody fuel consumption					Duff consumption		Temperature[1]
Unit	Small fuels	Large fuels	Total	Large-diameter reduction	Predicted diameter reduction	Duff-depth reduction	Predicted duff reduction	Depth of penetration
	tons/acre			inches		inches		inches
Yoncalla								
Outcome-A	16.6	13.6	30.2	2.3	2.1	0.9	1.3	2.6
Slick Corner-B	20.1	2.8	22.9	0.7	1.8	0.6	0.7	1.3
Conklin-3D	16.9	8.2	25.1	1.6	1.6	0.9	1.0	1.7

[1] Depth of heat penetration (60°C) from top of duff layer.

and mineral soil. As would be expected, the penetration of the 60°C heat pulse into the duff and mineral soil increased with the increase of large fuel consumption.

Data collected from three sites burned in 1987 and 1988 provide an indication of fuel consumption and temperature profile data that will be available for modification and validation of the heat transfer model. Future work will include fine tuning of field sampling procedures and further data collection, and model development and testing on several additional prescribed fires prior to the final adaptation of the heat transfer model for use in Oregon Coast Range forests.

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Roger Ottmar
PNW, Seattle

THE NATURAL REGENERATION OF CONIFERS AND ENVIRONMENT

Natural seedlings outnumber planted seedlings in some coastal Oregon clearcuts, but in other clearcut areas very little natural regeneration occurs. If the areas that will have abundant natural regeneration could be identified before harvesting, planting expenses could be reduced or eliminated on some clearcut units.

Unfortunately, it is difficult to identify clearcut areas that will regenerate naturally. Weather, seed production, rodent populations, and seedbeds vary from unit to unit and from year to year. Some environments consistently produce more natural seedlings than other environments, however, and they do so year after year under a variety of silvicultural treatments and seedbed conditions. A method is needed to compare environments with respect to their natural regeneration potential.

A new COPE study of natural regeneration is designed to provide that method. Its objectives include the relation of environment and vegetation to natural conifer regeneration and the measurement and description of seed sources as they relate to the occurrence of naturally established seedlings. Clearcut units in the Coast Range are now being measured to provide the data needed to attain these objectives.

Measured units are similar with respect to time and method of site preparation to minimize the confounding effects of differing silvicultural treatments, weather, and seed crops. All were broadcast-burned in the autumn of 1984 or the spring of 1985, and none were treated with herbicides. Eligible clearcuts have uncut stands that provide abundant seed sources at the north or east edges of the burned areas. Randomly located milacre plots are used to tally naturally established conifer seedlings present along these edges, where both seedbed and seed source conditions tend to be optimal for a given environment. To compare the natural regeneration potential in various environments, the number of seedlings tallied on the edge plots will be related to slope, aspect, elevation, soil texture, distance from the ocean, plant association, and the presence of plant species using multiple regression analyses.

Additional milacre plots within each clearcut area are being used to relate the presence and number of naturally established seedlings to distance and crown area of potential seed sources. An optical range finder, compass, and clinometer will be used to measure the distance and angle of the nearest conifer seed sources within each of eight 45° sectors radiating outward from the center of a plot. Effective seed source crown areas will be determined for each sector and for each milacre.

The measurements of natural regeneration, environment, and seed sources will continue through 1989 on clearcut units throughout the Oregon Coast Range. The resulting environmental comparisons and seed source analyses should make it possible to rank coastal areas with respect to natural regeneration potential and to identify which locales will provide adequate seed sources for natural regeneration of conifers.

Don Minore, PNW

OF INTEREST

MANAGEMENT OF LAMINATED ROOT ROT IN THE TILLAMOOK RESOURCE AREA OF THE SALEM BLM DISTRICT

The Tillamook Resource Area of the Salem BLM District manages approximately 67,000 acres of primarily Douglas-fir forest in the northern Oregon Coast Range. Laminated root rot, caused by the fungus *Phellinus weirii*, is widespread throughout the resource area. At least 5% of the lands in the Nestucca River drainage appear to be infected with this root disease, which is consistent with the rate of infection reported by others in western Oregon and Washington (Hadfield 1985; Lawson et al. 1983). However, nearly 11% of the BLM lands near Scappoose, Oregon, are infected with laminated root rot (Goheen 1988). Individual units vary considerably in their rate of infection, ranging from zero to 43%. Infection centers also vary in size, ranging from less than one acre to 17 acres or more. The more severe infections seem to be on sites where salal is common in the understory. These sites also tend to be on upper slopes and ridges.

Laminated root rot causes growth loss, mortality, and windthrow of infected host trees (Goheen and Goheen 1988). Species vary in their susceptibility to this disease. Of the tree species that occur in the Tillamook Resource Area, Douglas-fir and grand fir are susceptible, western redcedar is resistant, and hardwoods are immune (Hadfield 1985).

The causal fungus can persist for up to 50 years in stumps and large roots of host trees after they have been cut or killed and then infect, via root contacts, other susceptible trees that become established on the infected site. This allows the disease to persist into future generations.

In the Tillamook Resource Area, management to reduce the current and future losses to laminated root rot begins when potential timber sale units are examined. The locations of infections are noted on maps and entered into the record system. For units known to be infected, a stipulation is included in the timber sale contract requiring fallers to saw an "X" across the surface of any stumps showing the characteristic red-brown stain and/or laminated decay of this disease. Since the stain fades rapidly (Hadfield 1985), infected stumps must be marked at the time of felling. Stump marking helps to more accurately delineate infection boundaries for subsequent treatment of these areas. However, fallers often need training in distinguishing the stain and/or decay of laminated root rot from that of other fungi. Another valuable source of information is our timber sale contract administrators. They often report additional occurrences of laminated root rot in timber sale units.

Following site preparation, clearcut units are surveyed to determine the location of the infected areas by examining stump surfaces and/or roots for evidence of laminated root rot. Pathologists from Forest Pest Management, a USDA Forest Service working group, assist resource area personnel in the survey effort. Stumps in infection centers are often hollow or show crescent-shaped patterns of decay. Two roots on opposite sides of stumps marked with an "X" are examined to confirm the presence of laminated root rot. All infected stumps are marked with a stick and flagging. A 50-foot buffer is designated around the infected stumps. Resistant or immune species are planted in the infected area, including the buffer. Also, susceptible species must be prevented from becoming established in these areas. We are currently planting the majority of our infected sites with western redcedar. Small acreages have been planted with black walnut and western white pine on an experimental basis. Establishment success of planted seedlings is being measured during annual or biennial reforestation surveys.

During manual brush and hardwood control operations in infected plantations, tolerant, resistant, or immune species are selected as "leave" trees in a two-tree spacing around trees infected with laminated root rot. This treatment serves to help break the disease pathway to healthy susceptible trees (Hadfield 1985; Hadfield et al. 1986).

An essential part of successful disease management is record keeping since planting and maintaining less susceptible species in infected areas is a long-term commitment. Management support is another key element. Finally, we are very appreciative of the assistance we have received from the USDA Forest Pest Management Unit in Portland (Box 3623, Portland, OR 97208, (503) 221-2727), in managing our root disease problems. They have an excellent staff that is available to assist federal agencies with pest management problems.

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Walt Kastner, Silviculturist
Tillamook Resource Area, BLM

GIS NEWSLETTER FOR OREGON

The "Oregon Cursor", a newsletter published by the Oregon Water Resources Department, highlights the use of Geographic Information Systems (GIS) by various state and federal agencies throughout Oregon. Recent newsletters included information on the status of GIS use in National Forests in Oregon, a BLM study incorporating GIS in determining effects of forest management practices on stream flow, and a variety of other useful news. To receive a free subscription, contact: Oregon Water Resources Department, 3850 Portland Rd. NE, Salem, OR 97310. (503) 378-3671.

OPPORTUNITIES

ADAPTIVE COPE WORKSHOP ON FORESTRY AND LANDSLIDES ALONG THE OREGON COAST RANGE

Plans are coming together nicely for the Forestry and Landslides Workshop scheduled for March 7 and 8, 1989. Conference facilities have been reserved for this workshop at the Shilo Inn in Newport, Oregon. There are currently five sessions scheduled for the workshop. The first session will be an introductory session covering the history of landslide research in the Oregon Coast Range and an overview of the offsite effects of landslides. The second session will be a fairly technical overview of the current status of landslide research occurring along the Coast Range. The third session will cover the existing methodologies for recognizing high risk sites and areas of stability concerns in the Coast Range. The fourth session will include research results, case studies, and discussions of contemporary management practices that are being implemented to mitigate slope stability concerns. The final session will be a scoping session designed to solicit input regarding the direction future technology transfer opportunities should take. Workshop brochures should be in the mail near the first of the year. For further information, contact: Arne Skaugset, Adaptive COPE.

SYMPOSIUM ON WILDLIFE COMMUNITIES AND HABITAT RELATIONSHIPS IN OLD-GROWTH FORESTS.

March 29-31, 1989. Portland, Oregon

Presentations summarizing the findings of wildlife and plant community studies conducted from 1983 to 1986 in Douglas-fir forests in Washington, Oregon, and northern California. Patterns of vertebrate abundance, habitat use, and community structure will be reported from data collected in over 150 stands occurring along an age gradient from young to old growth. For further information, contact: Continuing Education Office, College of Forest Resources AR-10, University of Washington, Seattle, WA 98195. Phone: (206) 543-0867.

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COPE Report

Coastal Oregon Productivity Enhancement Program

Promoting Integrated Management of Oregon's Coast Range Forests Through Research and Education

Volume 2, Number 1 Winter 1989

The COPE Program

The Coastal Oregon Productivity Enhancement (COPE) Program is a cooperative effort between Oregon State University's (OSU) College of Forestry, the USDA Forest Service Pacific Northwest Research Station (PNW), the USDI Bureau of Land Management (BLM), other federal and state agencies, forest industry, county governments, and the Oregon Small Woodland Association. The intent of the program is to provide resource managers and the public with information relative to the issues and opportunities associated with the management of fish, timber, water, wildlife, and other resources of the Oregon Coast Range. The COPE Program emphasizes an integrated approach—an integration of research and education and an integration of scientific disciplines—to find effective ways to manage these diverse resources collectively.

The COPE Program has two related components: Fundamental COPE and Adaptive COPE. Comprised of OSU and PNW scientists based primarily in Corvallis, Fundamental COPE addresses problems related to riparian zone management and reforestation in the Coast Range through basic research. Adaptive COPE is comprised of an interdisciplinary team responsible for applying and adapting existing research information to solve specific management problems. Stationed on the coast in Newport at the Hatfield Marine Science Center, the Adaptive COPE team is also responsible for providing continuing education opportunities to facilitate technology transfer.

Published quarterly, the COPE Report provides a means to rapidly disseminate research findings, announce upcoming educational opportunities, and highlight recent publications and topics of interest. Its goal is to foster good resource management by helping people involved in the management of Oregon Coast Range resources to stay well-informed. Comments and suggestions concerning the content of the COPE Report are welcomed and encouraged. To receive this free newsletter, contact COPE, Hatfield Marine Science Center, Oregon State University, Newport, OR 97365. Phone: (503) 867-4011.

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ADAPTIVE COPE

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Readers are encouraged to contact authors directly for more detailed information regarding newsletter articles.

1988 REVIEW

COPE GAINS MOMENTUM

As we move into a new year, I thought it would be appropriate to review what was achieved in the COPE Program during 1988. It was certainly a year marked by some important milestones. One of the most significant things that happened was to bring our Adaptive Team up to full staffing. Located at the Hatfield Marine Science Center in Newport, this interdisciplinary team of 4 scientists and 6 support personnel conducts adaptive research studies and educational programs relative to integrated resource management in the Oregon Coast Range. In cooperation with county Extension forestry agents, it's their responsibility to insure that the results of COPE research reaches cooperating organizations and the public. Last year they produced 3 issues of this quarterly newsletter which has more than 1,000 readers, conducted 3 workshops on integrated resource management, initiated 5 adaptive research studies, met with numerous individuals from cooperating organizations, and gave several presentations. They also produced a draft compendium that describes research and administrative studies ongoing in the Oregon Coast Range. These accomplishments are remarkable when you consider that the Adaptive Team did not have a full complement of scientists until April.

Thirty-two scientists from both the USDA Forest Service Pacific Northwest Research Station and Oregon State University continued to work on 13 existing fundamental research studies while also starting 5 new ones. By October there were 23 adaptive and fundamental studies underway in the Oregon Coast Range. These studies are designed to answer a variety of questions that pertain to the two major management issues that are the focus of COPE work: riparian zone management and the reforestation of Oregon Coast Range forests. Despite the fact that the Program was only in its second full year during 1988, scientists produced 14 research publications reporting COPE-sponsored work. In addition, a draft of the first comprehensive book on Prescribed Fire in Pacific Northwest Forests, edited by Jack Walstad, Steve Radosevich and Dave Sandberg, was sent to the publisher. In other studies, new, and in some cases surprising information, was developed. In one study, the distribution and abundance of different fish populations was found to be closely related to habitat conditions and the distribution pattern differed among those streams intensively studied. The preliminary results of the riparian wildlife study found that the diversity of wildlife species in riparian areas and adjacent, forested upslope sites, was almost identical for the areas studied but the type of species varied. Studies of slope stability, plant competition, prescribed fire, economics, natural regeneration, and vegetation ecology also made significant progress.

A particularly significant step was taken this fall with the development of a long-range plan that was approved by the COPE Advisory Council during their November meeting. The plan provides the overall framework for program administration, structure, individual and organizational responsibilities, research focus, technology transfer activities, funding and program review during the next 10 years. Coordination among COPE scientists and with Extension forestry agents was further improved with the formation of the COPE Coordination Committee. This committee meets on a regular basis to discuss technical issues pertinent to COPE and facilitates coordination among individual studies and also with persons planning and directing COPE educational programs. The committee also provides a forum for better integration of fish, timber, wildlife, and economic-related studies.

Especially gratifying for those directly involved with COPE activities, has been the strong support received from cooperating organizations of which there were 50 during 1988. These included 5 federal agencies, 6 state agencies, 10 county governments, 26 companies and 2 natural resource associations. Funding for the Program increased from $525,000 in fiscal 1987 to approximately $1.2 million in fiscal 1988. In the current fiscal year, funding for COPE is $1.7 million and is projected to reach approximately $2.4 million by fiscal 1990. Major portions of this funding are provided by the USDI Bureau of Land Management and the USDA Forest Service Pacific Northwest Research Station.

Substantial progress has been achieved in a relatively short period of time and all indications point to an even more productive year in 1989.

Steve Hobbs
COPE Program Manager

ADAPTIVE COPE

FOREST PATTERNS AND UPLAND WILDLIFE COMMUNITIES: AN ADAPTIVE COPE STUDY

Throughout the world, natural habitats are being converted into managed forests or agricultural landscapes. Elsewhere lands long under cultivation are being abandoned and reshaped by natural processes. This rearrangement of habitats is having an impact on wildlife. Species preadapted to these changes are proliferating while other species are becoming extinct. Consequently, wildlife managers are increasingly interested in the link between forest pattern and wildlife community characteristics.

Relatively few studies have analyzed the broad scale vegetation patterns in the forests of the Pacific Northwest. Past and present changes in landscape-level features (e.g., distribution of stand types, stand sizes, and length of edge) are not well understood. Even less is known about how wildlife communities are responding to these changes.

Recent COPE surveys of private, state, and federal wildlife and timber managers revealed a high priority for research on wildlife response to stand type, patch size, habitat fragmentation, and stand connectivity in both riparian zones and in uplands. With such information, managers are best able to evaluate wildlife response to various forest management scenarios and to create the landscape patterns that optimize wildlife and other multiple-use objectives.

Managing wildlife habitat at the landscape level requires the ability to:

1. Determine vegetation patterns across the landscape
2. Associate individual wildlife species with specific habitat features;
3. Determine how wildlife species respond to changes in vegetation patterns across the landscape; and
4. Simulate future changes to assess the trade-offs of alternative management strategies.

Most previous wildlife habitat research falls under these headings. Analyses of vegetation patterns in natural and managed forests have been done at the stand level (e.g., Spies and Cline 1988, Spies et al. 1988) and landscape-level analyses are now underway in the Siuslaw National Forest (W. Ripple, personal communication). A large study of wildlife habitat use in the Pacific Northwest (including the Oregon Coast Range) is being conducted by the USDA Forest Service Old Growth Forests Wildlife Habitat Program, and a COPE study is exploring wildlife use of riparian zones (see COPE Report 1(1):2-3). The responses of wildlife to changing landscape patterns are more difficult to address, requiring long term monitoring and manipulative experiments. Finally, projecting the responses of vegetation and wildlife to management strategies over two or three timber rotation cycles requires the use of computer simulation. Dynamic models of wildlife habitat have been developed elsewhere (Verner et al. 1986) and need to be adapted to Oregon Coast Range conditions.

Links Between Forest Vegetation and Wildlife

This adaptive COPE study addresses primarily steps 1 and 2 above. The first phase assesses wildlife habitat associations in upland managed forests in the Drift Creek Watershed of the central Oregon Coast Range. The second phase maps habitat suitability at the landscape level. This study of upland habitats is designed to compliment other COPE studies on forest regeneration and on wildlife in riparian zones.

The first objective is to describe wildlife habitat associations in stand types that are not well studied. These include open-canopy plantations (0-8 years), closed-canopy plantations (25-30 years), and natural mature conifer stands (90-140 years). Young plantations often contain a variety of trees, shrubs, and herbaceous plants and are thought to support relatively high wildlife abundance and diversity. Older, closed-canopy plantations are thought to offer much less habitat diversity because herbs and shrubs are less abundant. These stands are little studied because intensive management has been used broadly for only the last 20-30 years which makes finding study sites difficult. The rapid rate of tree growth in the Coast Range has produced the closed-canopy structure in stands under 30 years old, allowing assessment of wildlife use of such stands. Mature Douglas-fir is the dominant natural forest type in the study area and will be used as a benchmark for comparison with the managed stands. Key questions are:

- What wildlife species are associated with each of these stand types?
- To what extent are these associations due to the presence of specific microhabitats?

The second objective is to determine if stand edges are recognized as unique habitats by wildlife species, and if so, how far into stands do edge habitats extend. Studies outside of the Pacific Northwest indicate that individual species often use edge and interior habitats differently. Some prefer edge habitats and avoid interiors while others use interiors but are rare in edges. It is widely assumed that some wildlife in the Pacific Northwest specialize on forest interiors and that these species are jeopardized by the fragmentation of natural forests. Unfortunately, virtually no studies have been conducted in the region and information is not available to determine if any species in our forests are interior specialists. Moreover, little is known about use of edge and interior habitats in managed plantations. Our research is designed to identify species associations with edge and interior habitats in the Coast Range. This work is a first step in determining how the size of cutting units and leave areas influences wildlife diversity.

The third study objective is to estimate the abundance of edge and interior habitats within these three stand types across the Drift Creek Watershed. This involves mapping stands within the watershed and classifying them in terms of suitability for each wildlife species. The resulting habitat map should be useful to land managers in determining the position of cutting units.

Approach

The field work involves measuring habitat and wildlife abundance over long transects which extend from the interior of one stand, across the edge, and into the interior of an adjacent stand. Two types of edges are being considered, open-canopy plantation/mature conifer edges and closed-canopy plantation/mature conifer edges. Three replicates of each of these comparisons have been designated for a total of six study sites. At each site three parallel transects have been laid out. These transects lie perpendicular to the edge, extending 260 m (280 yds) into the plantation and 400 m (440 yds) into the natural forest.

Small mammals and amphibians are sampled along the transects with pitfall traps during one-month periods in spring and fall. Birds are censused along the transects by sight and sound during winter and spring, with breeding territories being mapped in spring. Habitat characteristics and food abundance are also measured at regular intervals along the transects. These data will be analyzed by quantifying associations between wildlife and vegetation at the stand level, the microhabitat level, and as a function of distance from edge.

Field sampling will continue for two years. Thus far, study sites have been located, transects delineated, pitfall traps installed, and the first trapping session completed.

The results will be extrapolated to the landscape level by first using aerial photographs to map the distribution of the three stand types over the Drift Creek Basin. Each stand will then be classified in terms of suitability for each species of wildlife based on its vegetation type, size and edge/interior ratio. A preliminary estimate will then be developed of the abundance of upland habitats within the basin for edge, interior, and generalist species. This estimate will be refined in subsequent studies.

This landscape level extrapolation can best be done in close coordination with other COPE studies on geomorphology, vegetation, and riparian wildlife. The opportunity for integrated research among scientists of different disciplines represents great strength and opportunity of the COPE research program.

Summary

Our study is an early step in the sequence of research needed to determine the relationships between forest patterns and wildlife distribution in the Oregon Coast Range. Along with other ongoing projects, it will improve our understanding of the vegetation patterning and wildlife use of managed forests. The results are expected to be of use to land managers and will lay the groundwork for future field experiments and simulation modeling to determine the long-term responses of wildlife to forest patterns created under alternative management strategies.

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Andy Hansen and Jeff Peterson,
Adaptive COPE

FUNDAMENTAL COPE

PRODUCING TIMBER AND NON-TIMBER OUTPUTS THROUGH FOREST LAND AND RIPARIAN ZONE PLANNING

Crucial decisions impacting future forest, fish and wildlife, and recreational production in the Oregon Coast Range are continuously being made through two processes. Restrictions and special-use allocations such as headwall, riparian, and wildlife leave areas are being made through forest planning processes on public lands which are aimed at enhancing long-term productivity and sustainability of multiple resources. On private lands, regulations are imposed to protect multiple resources while simultaneously sustaining profits and employment in resource industries.

The riparian zone is but a small portion of the resource land-base, but with important impacts on fisheries and water quality. These same areas also provide corridors for wildlife and recreational corridors for streambank and boat fisherman and, in many instances, hikers and bird watchers. Because of this corridor effect, riparian zones are similar in many ways to transportation routes in that management decisions affecting these areas also have impacts throughout the total land-base. Hence, riparian zone management decisions must be viewed in the context of region-wide productivity of all resources within sub-drainages and drainages.

Broadly speaking, resource allocation decisions should be made after a careful assessment of benefits and costs of various alternatives. Some of the benefits and costs from tourism, fisheries, and forest products are market-derived with direct and quantifiable impacts on incomes, tax revenues, and employment. But many of the benefits of these resources are difficult to measure as they provide indirect, amenity values related to the quality-of-life. In turn, the costs of utilizing these resources are commonly expressed as opportunity-costs of market and nonmarket consumption foregone. In many instances, where benefits are indirect and difficult to quantify, we can still identify opportunity-costs. Accurately identifying these costs for various alternative resource management scenarios can help to efficiently allocate production of both market and nonmarket goods derived from these resources on particular land or watershed areas to lowest cost or highest net-benefits.

Non-Spatial Versus Area-Based Planning

Most models for resource planning currently used in the Oregon Coast Range are non-spatial. Similar areas of habitat, timber stands, or environmental concerns (e.g., steep slopes or riparian zones) are aggregated and then managed to maximize a physical or economic objective constrained by concerns of sustainability and minimum or maximum amounts of habitat, sediment, or scenic modification desired. Properly used, these models can provide supply functions for water purity or game habitat that relate increasing benefits of a particular resource to increasing unit costs. This approach can target aggregate areas where opportunity costs are high and, conversely, areas where they are negligible or low. They can also provide an accounting method for rationalization and allocation of costs where other than volume, value, or employment maximization strategies are recommended. These methods, however, deal in aggregates while forest and riparian land management is most often applied on small areas of 20 to 50 acres. Hence, spatial concerns such as accessibility and adjacency of habitat treatments over time must also be incorporated into economic models.

Area-based analysis deals with these transportation networks, riparian corridors, and adjacency concerns. We are interested in how much of a habitat type is treated at a given time, and where these treatment areas are as well. We also are interested in the riparian corridor as a whole, rather than as detached units, and in the relationship between treatments in and adjacent to the zone as they relate spatially to treatments across the whole land base.

In the first year of the COPE program, we have developed methods to evaluate the above concerns. We have developed simpler solution methods for implementing area concerns previously not applied because of methodological complexity. Area-based concerns are primarily used for current planning as compared to planning over many decades. Development of methods for smoothly integrating near-term area concerns with long-term sustainability concerns are needed. By implementing these analysis techniques on COPE demonstration watersheds, we hope to improve timber, fish, and recreation production and development throughout the coastal region.

Doug Brodie
OSU Forest Resources Management Department

BLOWDOWN OF STREAMSIDE BUFFERS

The Oregon Forest Practices Rules address the need for both minimizing stream sediment and providing a long-term supply of woody debris to the stream channel. Yet, prescriptions for achieving these two goals may be at odds in the case of blowdown of streamside buffers. Under certain conditions trees left next to streams as a future source of debris can blow down catastrophically and create conditions that might increase the amount of sediment in stream channels.

Buffer strip blowdown can introduce root wads and attached soil into stream channels. The frequency of shallow landslides may increase along streams when slope support is reduced after trees uproot. Large additions of woody debris into the stream channel over a short period can divert the water flow into stream banks and release stored sediments. Conversely, the input of large wood can store large quantities of sediment. Therefore, the magnitude of stream sediment increases, when they occur, is unknown.

The perceived risk of wide-spread blowdown and of subsequent increases in stream sediment has prompted some landowners in the Coast Range to request waivers to the Forest Practices Rules for streams where the probability of buffer strip blowdown is considered to be high. The State Department of Forestry has granted these waivers on occasion.

The Forest Engineering Department at Oregon State University is studying where buffer strip blowdown is likely to occur throughout the Oregon Coast Range. Whether stream sediment levels increase appreciably where blowdown does occur is also being studied.

The study includes about 40 streamside buffers located throughout the central and northern Coast Range. A variety of timber types, stream valley configurations, and exposure levels are represented. Most buffers meet current State requirements for width, canopy closure following cutting, and numbers of conifers.

We are mapping standing trees and stream channel characteristics. We are also inventorying blowdown and noting topographical features associated with high-risk sites. Additionally, we are documenting streamside soil movement, landslides, and changes in channel geometry attributable to blowdown. This winter, during major storms, we are taking water samples from selected sites upstream and downstream of buffers with heavy blowdown.

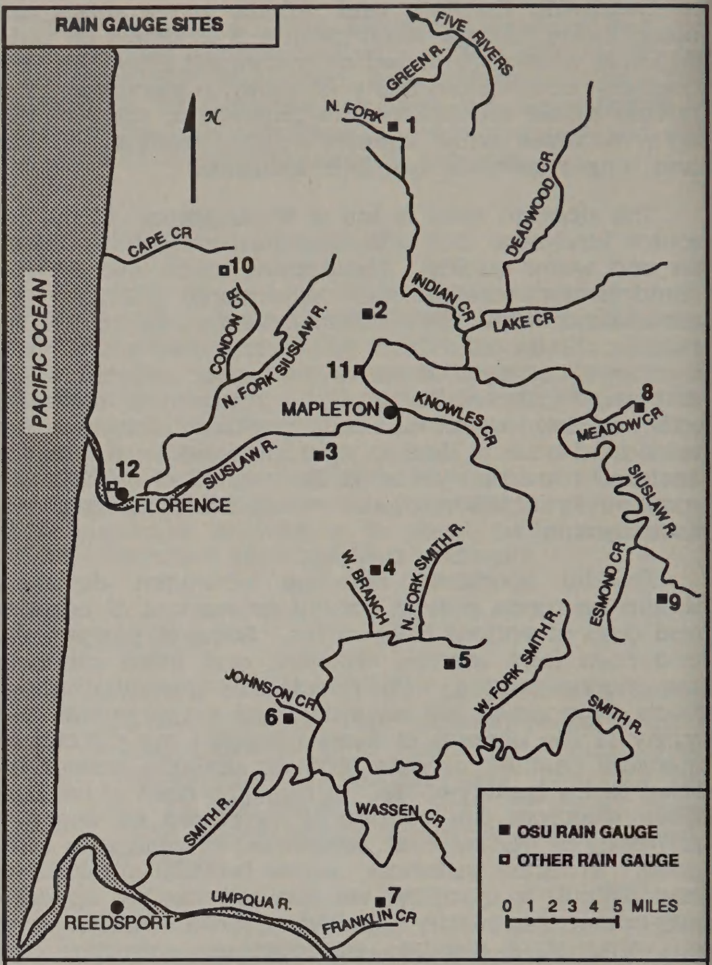
Results from this study will help land managers and Department of Forestry officials determine where buffer blowdown is likely to occur and if sediment levels increase when buffers do blow down. This may help resolve conflicts with enforcing current rules or lead to changes in the rules to better manage riparian areas and minimize costs to landowners.

Chip Andrus
Hank Froehlich
OSU Forest Engineering Department

OF INTEREST

RAINFALL DATA NOW AVAILABLE FOR THE CENTRAL COAST RANGE

Landslide activity in the Coast Range is sporadic, limited mostly to the few largest storms each winter. Understanding landslide behavior requires detailed information about rainfall amounts and intensity. Yet, within the central Coast Range we know very little about precipitation amounts, patterns and intensities. The few gauges in operation are restricted to coastal towns or valley bottoms. Rainfall increases with elevation and inland sites receive more rain than sites next to the ocean. So, we suspect that existing gauges are greatly underestimating rainfall on higher slopes where landslides initiate.



#	NAME	ELEV (FT)	GAUGE OWNER-SHIP
1	Indian Cr.	1040	OSU
2	Thompson Cr.	780	OSU
3	Sweet Cr.	1040	OSU
4	South Canyon	1640	OSU
5	Smith R.	1220	OSU
6	Johnson Cr.	760	OSU
7	Wassen Cr.	1400	OSU
8	Kirk Cr.	1400	OSU
9	Mill Cr.	1000	OSU
10	Herman Peak	2000	RAWS
11	Mapleton	40	NOAA
12	Florence	20	NOAA

Figure 1. Rain gauges in the central Coast Range.

To help fill this information gap the Forest Engineering Department at Oregon State University has established nine recording rain gauges, located in the most landslide-prone areas of the central Coast Range. These gauges, along with three existing gauges, provide a network extending 42 miles north of the Umpqua River and 27 miles inland from the coast (Figure 1). Gauges range from 20 to 2500 ft in elevation. Information from the 12 gauges will help us understand elevational and spatial differences in rainfall. We will also use information gathered at the radar imagery station on top of Mt. Ashland in southwestern Oregon. High intensity rainfall cells can be tracked across the central Coast Range using the hourly radar scans taken by the station.

The rainfall data is being archived on computer files by the Forest Engineering Department and will be available for others to use. Contact Chip Andrus at 754-2380 for details.

Chip Andrus
Hank Froehlich
OSU Forest Engineering Department

OPPORTUNITIES

REFORESTATION PLANNING AND COST CONTROL

March 28-30, 1989. OSU, Corvallis, OR.

This workshop will emphasize the use of microcomputer spreadsheets in reforestation planning and cost control. Use of the personal computer as a tool in this process will be demonstrated and then each participant will be allowed to learn it. Participants will complete exercises and a reforestation prescription using spreadsheet templates. This course is intended for silviculturists, reforestation foresters, and other workers involved with reforestation planning and supervision. For more information contact the Conference Assistant at (503) 754-2004.

PRACTICAL APPROACHES TO RIPARIAN RESOURCE MANAGEMENT

May 9-12, 1989. Billings, MT.

The primary goal of this workshop is to bring together new methodologies in riparian management in order to increase resource productivity. A secondary goal is to promote and stimulate discussion among the wide variety of interests involved in riparian area management including technical specialists, resource planners, managers, and landowners. Topics for paper and poster sessions include: management strategies; inventory and monitoring techniques; forestry in riparian areas; habitat rehabilitation; urban and suburban development; stream geomorphology; and livestock grazing. For more information contact Glenn Phillips, Montana Department of Fish, Wildlife and Parks, Capitol Station, Helena, MT 59620.

RECENT PUBLICATIONS

SPRING AND WINTER BIRD POPULATIONS IN A DOUGLAS-FIR FOREST SERE. by D.A. Manuwal and M.H. Huff. 1987. J. Wildl. Manage. 51 (3):586-595. Knowledge of the habitat requirements of wildlife species is essential for the management of wildlife diversity on forest lands. The USDA Forest Service's Old-growth Wildlife Habitat Research Program was designed to determine the abundance of several types of wildlife in forest stands of various ages. This article is one of the first publications to result from the study. It reports on bird abundance in natural young (42-75), mature (105-165), and old-growth (250+ years) stands in the southern Washington Cascades in spring and winter. In spring, the authors found few differences in bird species diversity or abundance along the stand age gradient. Sixteen species (35%) were significantly more abundant in specific age classes. In winter, diversity and abundance were greater in old-growth than in younger stands. These results raise several important management questions. Given the large differences in habitat characteristics between age classes, why were differences in birds in spring not greater between these stand types? Why were bird diversity and abundance greatest in old-growth stands in winter? Is bird habitat use influenced by the size of the stand? How would results from similar studies in managed forests compare to those of this study?

AH

BULLDOZING STUMPS AND NITROGEN FERTILIZATION AFFECT GROWTH OF DOUGLAS-FIR SEEDLINGS by W.G. Thies and E.E. Nelson. 1988. Can. J. For. Res. 18:801-804. This study tested the effect of broadcast fertilizer application and removal of stumps on Douglas-fir seedling growth on a site where laminated root rot (Phellinus weirii) was present in the previous stand. Both of these techniques have been proposed in the past as options for controlling root rot by exposing the pathogen to competition from other soil microorganisms and by enhancing the competitive ability of other organisms. This study is the first to combine these two techniques of stump removal with a bulldozer and broadcast fertilization with ammonium nitrate. The site was on a 12% slope with a gravelly loam soil, so the operation of heavy equipment was possible with no evidence of soil compaction. After eight growing seasons, seedlings were taller and had larger diameters on bulldozed and fertilized plots, with no evidence of an interaction between treatments. The lowest level of fertilization (336 kg N/ha or 300 lbs N/acre) resulted in the same growth increase as the highest level (1345 kg/ha or 1200 lbs/acre). At this time it is still too early to evaluate the effect of the treatment on the root rot pathogen, but the plots will be monitored and this important information will be released when available. This publication is available through the USDA Forest Service, Pacific Northwest Research Station, Corvallis, OR 97331.

CB

SOIL COMPACTION: AN ECONOMIC MODEL by R. Stewart, H. Froehlich, and E. Olsen. 1988. West. J. Appl. For. 3:20-22. This technical note describes a model that was developed to help assess the impact of compaction due to ground-based logging systems under different harvest specifications. The model integrates a stand-growth simulator for Douglas-fir with model components that relate planned skid trail density to the number of vehicle trips and calculates the subsequent change in soil bulk density and site productivity. An additional model component relates management plan changes, such as alternative skid road spacing, to changes in production rates and then discounts all benefits and costs to present values by standard discounting procedures. An example of how the model works is given in the technical note. For the conditions described in the example, the model suggests that designated skid trails or tillage of skid trails would be more cost effective in mitigating compaction-induced loss of productivity than skyline yarding systems. This paper is available from OSU College of Forestry Business Office, Corvallis, OR 97331.

AS

FLOW CAPACITY OF CULVERTS ON OREGON COAST RANGE FOREST ROADS. by B.T. Piehl, M.R. Pyles, and R.L. Beschta. 1988. Water Resour. Bull. 24(3):631-637. This study evaluated the peak flow capacity of 128 stream-crossing culverts on federal, state, and private lands throughout the central Oregon Coast Range. The calculated peak flow capacity of the culverts was compared with the design guidelines provided by the Oregon State Forest Practice Rules which require that stream-crossing culverts have the capability of passing a 25-year peak flow event. According to regional peak-flow equations, 17% of the culvert installations inventoried could not pass the 25-year peak flow without overtopping the road. However, at each of these installations a culvert one size (6 inches) greater in diameter would have provided sufficient capacity to meet the 25-year flow requirement. Approximately 40% of the installations could not pass the required flow at a headwater to diameter ratio of one. The paper also discusses the performance of culverts over various ownerships and watershed sizes. Reprints are available from: College of Forestry, Oregon State University, Peavy Hall #154, Corvallis, OR 97331.

AS

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COPE Report

Coastal Oregon Productivity Enhancement Program

Promoting Integrated Management of Oregon's Coast Range Forests Through Research and Education

Volume 2, Number 2 Spring 1989

The COPE Program

The Coastal Oregon Productivity Enhancement (COPE) Program is a cooperative effort between Oregon State University's (OSU) College of Forestry, the USDA Forest Service Pacific Northwest Research Station (PNW), the USDI Bureau of Land Management (BLM), other federal and state agencies, forest industry, county governments, and the Oregon Small Woodland Association. The intent of the program is to provide resource managers and the public with information relative to the issues and opportunities associated with the management of fish, timber, water, wildlife, and other resources of the Oregon Coast Range. The COPE Program emphasizes an integrated approach—an integration of research and education and an integration of scientific disciplines—to find effective ways to manage these diverse resources collectively.

The COPE Program has two related components: Fundamental COPE and Adaptive COPE. Comprised of OSU and PNW scientists based primarily in Corvallis, Fundamental COPE addresses problems related to riparian zone management and reforestation in the Coast Range through basic research. Adaptive COPE is comprised of an interdisciplinary team responsible for applying and adapting existing research information to solve specific management problems. Stationed on the coast in Newport at the Hatfield Marine Science Center, the Adaptive COPE team is also responsible for providing continuing education opportunities to facilitate technology transfer.

Published quarterly, the COPE Report provides a means to rapidly disseminate research findings, announce upcoming educational opportunities, and highlight recent publications and topics of interest. Its goal is to foster good resource management by helping people involved in the management of Oregon Coast Range resources to stay well-informed. Comments and suggestions concerning the content of the COPE Report are welcomed and encouraged. To receive this free newsletter, contact COPE, Hatfield Marine Science Center, Oregon State University, Newport, OR 97365. Phone: (503) 867-4011.

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ADAPTIVE COPE

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Readers are encouraged to contact authors directly for more detailed information regarding newsletter articles.

ADAPTIVE COPE

FORESTRY AND LANDSLIDES WORKSHOP HELD IN NEWPORT

The first Adaptive COPE workshop of 1989, "Forestry and Landslides in the Oregon Coast Range," was held March 7 & 8 in Newport, OR. Approximately 240 participants from five western states and British Columbia attended the workshop including speakers and Adaptive COPE staff. The turnout was twice what was expected which illustrates the wide-spread interest in this topic and also the awareness of the COPE program. Workshop participants were primarily field-level resource managers and technical specialists from the timber industry and state and federal agencies. Other groups in attendance included Native American tribal representatives, university students and administrators, researchers, and private consultants in both resource management and engineering. The workshop was considered a success by all counts. Presentations were consistently good, conversations were lively, and the breaks and lunches allowed for ample socialization. Even the weather cooperated allowing workshop participants an opportunity to enjoy two beautiful days on the Oregon Coast.

The workshop consisted of five sessions. They were: an introductory session, a session covering the geomorphology and mechanics of landslides, a session covering current methods for determining high risk sites, and a session on alternative practices to mitigate landslides. The 20 speakers were university administrators, university and Forest Service researchers, and representatives from private industry and both state and federal resource management agencies.

The final part of the workshop was devoted to a scoping session. While the attendance at the scoping session was considerably less than the rest of the workshop, what was lacking in quantity was more than compensated for in quality. Between the scoping session forms and the formal session, a number of common themes regarding the direction Adaptive COPE technology transfer in landslides should take were presented.

Out of the possible user groups of slope stability information, three groups were identified as being the primary users. The largest user group is field-level resource managers consisting mostly of foresters and logging engineers who are responsible for the management of landslide-prone terrain but have had little or no formal training in slope stability. The second user group is smaller and consists of technical experts who are mostly technical staff to the field level resource managers. This group has had technical training in at least some aspects of slope stability. The final group is primarily administrators. This group includes woodland managers, district rangers, and others with similar levels of responsibility.

The overwhelming vote for future technology transfer was more field trips. Opinion was divided regarding the style of the field trips. The two styles were either a large workshop, like the one in March, followed by a field trip or a smaller, more localized workshop followed by a field trip that would concentrate on local geomorphic and geologic hazards. There was a request from the technical specialists for small workshops that would present technically more rigorous material that would be directed specifically to their group and include the latest research on slope stability. There was considerable discussion on how to reach out to resource administrators but there was not a concensus on the best way to do it.

To those of you who attended the workshop and took the time to complete the various evaluation and scoping session forms and especially to those of you who were able to stay for the scoping session, please accept our most sincere appreciation. As a result of this workshop and these discussions we have a better understanding of your expectations and technology transfer needs from the Adaptive COPE program.

AS

ALTERNATIVES TO TREATMENT WITH FIRE AND HERBICIDES: A SYNTHESIS OF REFORESTATION TECHNIQUES

Unwanted herbaceous and woody vegetation rapidly invades and often dominates forest sites after harvest. This is particularly true on the productive sites of the Oregon Coast Range where competition from vegetation can limit the growth and survival of conifers. Removal of competition can be accomplished using several tools. However, managers face increasing restrictions on the use of the traditional vegetation management methods of slashburning and herbicides.

Slashburning is also used to clean a site after harvest, increasing accessibility for planters and reducing the danger of wildfire. However, the amount of prescribed burning land managers may do is decreasing each year. This trend should continue since the long-term smoke management goals of Oregon are to reduce forestry-related smoke emissions by 50% of the average annual levels produced between 1976 and 1979. Burning is particularly limited in "designated areas" near urban and recreational areas.

Forestry herbicide use has been the subject of a great deal of controversy and has been curtailed on federal lands since 1984. While the Forest Service and the Bureau of Land Management have completed new Environmental Impact Statements and federal agencies may regain use of herbicides, this use will probably be limited, resulting in areas where other vegetation management tools will be necessary. State and private foresters will also be interested in alternatives to herbicides if they are cost effective.

In the last few years, some managers have experimented with alternative vegetation management treatments and reforestation strategies. Information about what techniques are being used and the effectiveness of these techniques has not been compiled and is not readily available to land managers in the Oregon Coast Range. The silviculturists on the Adaptive COPE team are working to fill this information need.

From a quick review of the literature, and visits with land managers, an outline for the report has been developed (Table 1). After an introduction, the report will include a review of traditional Coast Range management, focusing on the intensive regeneration of Douglas-fir. Then alternative reforestation methods that will work with the traditional clearcut system will be covered. This includes alternative site preparation treatments, release treatments, and the use of different planting strategies. Alternative harvesting systems will also be discussed, as well as entirely different management practices.

Table 1. Outline for report on alternative reforestation strategies.

I. Introduction/Justification
II. Review of Traditional Coast Range Management
III. Alternative Reforestation Practices
    A. Alternative Site Preparation
        1. Burning excluded
            a. No site prep beyond harvest disturbance
            b. Mechanical piling/scarification
            c. Planting lanes cut by saw crews
            d. YUM yarding
        2. Limited burning permitted
            a. Piling and burning
    B. Alternative Seedling Release Systems
        1. No herbicide use
            a. Manual release
            b. Forage seeding
            c. Forage seeding with livestock grazing
            d. Pre-harvest slashing or burning of brush and hardwoods
        2. Minimal herbicide use
            a. Thin-line and spot treatment of brush and hardwoods
            b. Pre-harvest localized treatment of brush
    C. Alternative Harvest/Regeneration Systems
        1. Shelterwood harvesting
        2. Uneven-aged management
    D. Planting Strategies
        1. Using very large stock to outgrow competitors
        2. Fertilizing seedlings
IV. Alternative Management Practices
        1. Red alder as a timber crop
        2. Commercial thinning of conifer stands
V. Summary and Conclusions
VI. Literature Cited

Situations considered under alternative site preparation methods will be where burning is excluded as well as where limited burning is permitted. Where no burning is allowed alternative possibilities include: no site preparation beyond harvest disturbance; mechanical piling and scarification; chemical site preparation; cutting planting lanes with chainsaws; and YUM yarding. Piling and burning would be involved where limited burning is possible.

For alternative release treatments, we will also consider situations where herbicides are excluded and where limited use is allowed. Where no herbicides are used alternatives include: manual release; forage seeding; and forage seeding with livestock grazing. Minimal herbicide use will allow spot treatments of brush and hardwoods, including thin-line treatments. There is an increasing interest in preharvest vegetation management which will be explored both with and without the use of herbicides.

Consideration will also be given to fertilizing seedlings or using very large, or physiologically more vigorous, planting stock to outgrow the competition and, perhaps, avoid the need for site preparation or release. Alternative harvesting systems, including shelterwoods and unevenaged management, are being used or have been suggested to reduce the use of fire and herbicides. Finally, two alternative management practices will be covered. The first is utilizing red alder as the timber crop especially in areas where it already dominates the stand. The second alternative is increased reliance on commercial thinning to maintain wood production and delay final harvest.

In addition to using information from published studies, we are interested in finding out about methods that you are using. If you have used any of the methods mentioned or some other alternative reforestation technique, we would like to learn more about it and urge you to contact us at (503) 867-4011.

We plan to publish the synthesis as a technical report in 1990 and will let you know when it becomes available. Also planned is a workshop in early 1990 that will focus on alternative reforestation techniques. If you are interested in contributing to this workshop, please contact us with your ideas.

Cathie Bacon and Steve McConnell
Adaptive COPE

ROOT REINFORCEMENT IN SHALLOW FOREST SOILS: DEVELOPMENT OF A MODEL

Review of Existing Approaches

The current understanding of the role of root reinforcement in the stability of shallow forest soils is inferred from debris avalanche inventories, laboratory and field investigations of the strength of reinforced soils, and root reinforcement modeling. These interpretations have led to two different approaches to forest management, landslides, and root reinforcement on steep forested slopes in the Oregon Coast Range. The first approach is based primarily on results from debris avalanche inventories and is a geomorphic hazard zoning approach. The second, a process-oriented, mechanistic approach, is based on results from root reinforcement modeling and laboratory and field investigations of the strength of reinforced soils.

Debris avalanche inventories, which are surveys of landslides on harvested and unharvested landslide prone slopes, are the basis of the geomorphic hazard zoning approach to root reinforcement and landsliding. There are problems using debris avalanche inventory data to investigate root reinforcement because very few debris avalanche inventories were designed to yield such interpretations. In fact, very few of the inventories were designed and carried out to yield good, unbiased estimates of landslide rates prior to harvesting (Pyles & Froehlich, 1987). Nevertheless, it is commonly inferred from debris avalanche inventories that timber harvesting causes an increase in the frequency of non-road related, or in-unit, landslides and that this increase is due to a loss of root reinforcement in harvested areas. A second inference from debris avalanche inventories that supports root reinforcement is an assumed link between time to maximum reduction in root strength and the inferred increase in landsliding. Ice (1985) presents a catalogue of the debris avalanche inventories of the Pacific Northwest along with a summary of results.

The mechanistic approach to root reinforcement is a result of laboratory and field investigations of the increase in soil strength due to root reinforcement as well as root reinforcement modeling. In laboratory tests the increase in soil strength due to root reinforcement is quantified by comparing the strength of soils without roots with the strength of soils reinforced by either natural plant roots or artificial reinforcing elements. Field tests have also quantified root reinforcement by comparing the strength of fallow versus rooted soils as well as comparing the strengths of soils reinforced by different root densities. Another field investigation technique is to solve for the increase in soil strength due to root reinforcement by backcalculating slope stability equations for existing landslides. This technique requires that all the stability equation parameters, except the component of soil strength due to root reinforcement, be known (slope, soil profile geometry, soil unit weight, soil strength, and groundwater condition). In reality, all these parameters cannot be determined directly, therefore they must be estimated or assumed. The magnitude of soil strength increases due to root reinforcement calculated by the above techniques has been compiled by Sidle et. al. (1985).

The above laboratory and field investigations have been augmented by efforts to model the process of reinforcement. The reinforcement process involves adding a reinforcing element with high tensile strength, a root, to a material with essentially no tensile strength, soil. Modeling efforts to date have concentrated primarily on the increase in tension that occurs in the reinforcing element as it is stretched across a failure plane or shear zone. The increase in tension in the reinforcing element acts to pull the failing soil together causing an increase in strength. A mechanistic model has been developed which solves for the increase in soil strength, [Δs], using the equation:

$$\Delta s = 1.2 T_R (A_R/A)$$

In this equation the increase in strength is directly proportional to the average tensile strength of the roots, TR, and the root area ratio, AR/A. The development of this model is reported by Greenway (1987).

Management Implications

The management of steep, landslide prone slopes in the Oregon Coast Range is influenced by how the subject of root reinforcement is approached. The two approaches to the problem discussed above result in identical management practices. The geomorphic hazard zoning technique to managing steep, high risk terrain is to treat all high risk sites equally. It assumes that there will be an increase in landslide frequency on these sites after harvesting and that this increase is attributed to the loss of root reinforcement. There are two management tasks required to implement this approach. First the forest land must be divided into zones which represent the risk of landslides or geomorphic hazard. Then the high risk zones must be managed in a manner that minimizes damage to the roots system. This management can range from leaving the original stand intact, such as headwall leave areas, to leaving the hardwood understory intact after harvesting by discouraging prescribed burning and the use of silvicultural herbicides. The key to this approach is that no quantity is put on the magnitude of root reinforcement and no attempt is made to differentiate between the relative stability of high risk sites. All high risk sites are assumed to be equally at risk and root reinforcement is assumed to be critical to the stability of all the sites, thus management practices on all high risk sites should minimize impacts on the root systems.

The mechanistic approach to the issue of root reinforcement is implemented differently, even though it results in the same management practices for landslide prone slopes. For this approach, a mechanistically derived slope stability model or formalized process is used to evaluate the stability of high risk sites. Then a root reinforcement model or empirically derived quantities of strength increases due to root reinforcement are used to assess the impact harvesting will have on stability of the site. The Level I Stability Analysis (LISA) is an example of a stability model that is currently being used. The mechanistic approach can, theoretically, evaluate the impact of harvesting on individual sites. However, the current problem with this approach is that the parameters required for the slope stability model can not be reliably determined for shallow forest soils. As a result, the models are no more valuable than a geomorphic hazard rating meaning that at best they can be used to delineate high risk sites. In that application, root reinforcement is treated as essentially a fixed quantity and is assumed to be critical to stability. Thus the management implications for the mechanistic approach are the same as those for the geomorphic hazard rating approach. The mechanistic models are used to delineate high risk sites and root reinforcement is assumed to be a fixed quantity which is critical to stability. This leads to the conclusion that all high risk sites must be managed in a manner that minimizes damage to the existing root system.

Research Challenge

The problem with these approaches is that they require all high risk sites to be managed similarly despite the fact that they will not respond to management similarly. High risk sites can, in general, be divided into three categories: those sites unstable enough so that they will fail whether managed or not, those sites that are stable and will not fail even if managed, and those sites that will fail only as a consequence of management. Only a minority of high risk sites ever fail over a period of time. Management induced landslides must be a subset of the total number of landslides. Therefore, while the exact numbers will never be known, management induced, in-unit landslides will occur on only a minority of the total number of high risk sites. This results in protection measures being implemented on both stable as well as unstable high risk sites which can result in a foregone gain of merchantable timber, an increase in logging costs, and a decrease in the commercial forest land base available to grow timber.

The challenge to COPE researchers is to improve the current approaches to forest management on steep slopes so that the stability of high risk sites can be more correctly evaluated and special management practices can be applied to only those sites requiring them. Research is underway to improve both the geomorphic hazard zoning approach and the mechanistic approach to the management of high risk sites. A Fundamental COPE project currently underway has an inventory of over 1200 headwalls covering a variety of terrains and vegetation types (COPE Report 1(1):6-8). Statistical treatment of the data for these headwalls will improve the geomorphic hazard zoning approach.

Conceptual Model Development

The remainder of this article will be dedicated to an Adaptive COPE research project that has as its objective to improve the mechanistic approach to root reinforcement. The project will build on the existing models of root reinforcement. Improvement of the mechanistic approach will require more than just an increased understanding of how roots reinforce shallow forest soils. It will also require increased sophistication in the determination of the intrinsic stability of high risk sites so that those sites in which root reinforcement is critical to stability can be identified and properly managed. There are research projects currently underway or being considered that will deal with a number of topics geared to help achieve this goal. However, development of a more technically correct model of how roots reinforce shallow forest soils is considered an important first step in improving the mechanistic approach to management of landslide prone slopes.

Before describing the conceptual development of the root reinforcement model, there are two concepts that must be discussed. The first is a deformation-based definition of strength and the second is shear stress transfer at the soil-root interface. To help explain the concept of deformation-based strength, consider the simple physical model in Figure 1. In this model, there is soil on both sides of a shear plane with reinforcing elements extending across the shear plane. If the ends of the reinforcing elements are pinned and can't move and a failure plane is forced to develop by moving the top of the soil block with respect to the bottom, the reinforcing elements will deform as shown and they must get longer. If the reinforcing elements get longer, then they must experience an increase in tension. The increase in tension pulls the two soil blocks together causing an increase in strength. Thus, the increase in strength between the two soil blocks is directly proportional to the increase in tension in the reinforcing elements which is, in turn, directly proportional to the distance the two soil blocks have moved relative to each other. This distance is defined as deformation. In summary, a deformation-based definition of strength allows for a range of soil strengths to be calculated given a measurement of the soil's deformation.

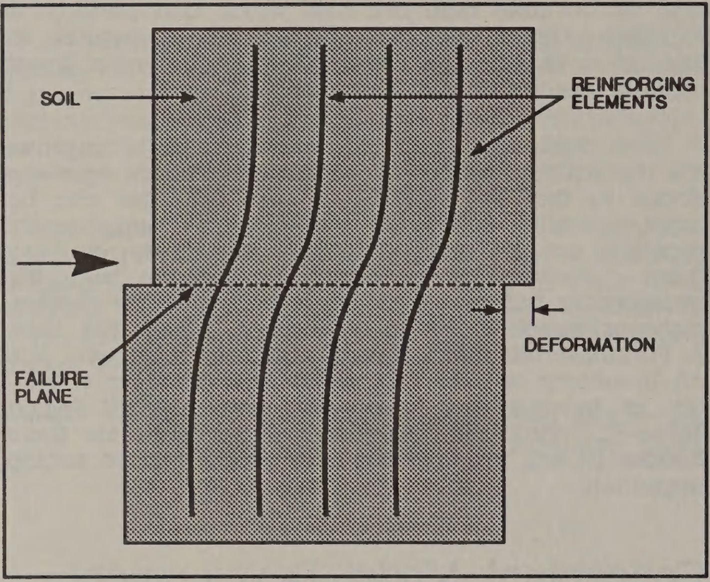

Figure 1. A model of a reinforced soil block deforming along a failure plane with the accompanying deformation of the reinforcing elements.

The importance of a deformation-based definition of strength becomes apparent when the concept of shear stress transfer at the soil-root interface is considered. Assume the ends of the reinforcing elements shown in Figure 1 are not pinned, but they are not allowed to move as the soil blocks move relative to each other. For an increase in tension to be developed in the reinforcing elements there must be a force to pull on each end. This force is the shear stress transfer and it is generated by the friction between the reinforcing element and the soil. As the soil blocks start to move, friction between the soil and the reinforcing element generates a force that resists the movement of the reinforcing element and causes an increase in the tension in it. However, an increase in the strength of the soil block will be generated only for as long as the soil is competent enough to mobilize a shear stress transfer and pull on the ends of the reinforcing elements. This is an important concept because soil is known as a "strain-softening" material which means that as soils deform they lose their strength or competence. A consequence of this loss of competence in the soil is that the maximum potential increase in strength in a reinforced soil is not necessarily governed by the ultimate tensile strength of the reinforcing elements, but instead by the ability of the soil to generate a shear stress transfer as it deforms. It is possible that the soil may deform to a point beyond which the reinforcing elements simply pull out. The strength increase associated with a deformation in which roots pull out will be substantially less than that calculated using the average ultimate tensile stress of the roots. This illustrates the importance of a deformation-based definition of strength and shear stress transfer to a slope stability model.

With the development of these concepts, it is possible to describe a conceptual model which characterizes the process of root reinforcement in shallow forest soils. Consider again the situation in Figure 1, in which the top half of a soil block with reinforcing elements in it has moved relative to the bottom half causing the development of a failure plane and the deformation of the reinforcing elements. Assume that the shear zone is infinitely thin and note that the problem is symmetrical. The top soil block can be replaced by forces representing the tension in the reinforcing elements. The tension forces can be divided into their horizontal and vertical components and the problem can be solved in two parts: horizontal forces and vertical forces.

The problem involving the horizontal forces might be solved by using the solution for a laterally loaded pile in a flexible foundation. The input parameters are the engineering properties of the reinforcing elements and the soil, the geometry of the reinforcing elements, and the initial deformation of the soil blocks. The solution to the horizontal problem yields the deformed shape of the reinforcing element and the horizontal component of the tension in it. Knowing the deformed shape of the reinforcing element, the increase in length of the element and the angle it makes with the failure plane can be computed.

The problem involving the vertical forces might be solved by using the solution for an axially loaded pile. The input parameters are the engineering properties of the reinforcing elements and the soil, the geometry of the reinforcing element, and the increase in length of the reinforcing element from the previous solution. The solution to the vertical problem yields the vertical component of the tension in the reinforcing element.

From the solution of the horizontal and vertical components of the problem, the tension in the reinforcing elements and the angle the reinforcing elements make with the failure plane are computed. Given these two quantities, the increase in strength due to reinforcement can be calculated. Note that this method gives a unique value of strength increase for each increment of deformation. A unique value of strength increase is a requirement of this root reinforcement model.

Once the mathematics for a single reinforcing element have been developed, it is a simple task to loop through the process given multiple reinforcing elements. Reinforcing elements of many different sizes and materials can be handled by changing the inputs to the model for the appropriate loop. The mathematics can even be adjusted to account for different orientations of the reinforcing elements. The model calculates an increase in strength for each combination of orientation, size, and material of each reinforcing element and then sums up the total to calculate the total increase in strength for a potential failure surface.

The conceptual model described above is the first step to putting together a more technically correct model for root reinforcement. The model is more technically correct because it allows for a deformation-based definition of strength and shear stress transfer at the soil-root interface. The development of this analytical model is just the initial step in this research project. Once the mathematics of the model have been worked out, it will be tested and calibrated using a physical model and eventually field tested. This root reinforcement model is just a small part of the total mechanistic model that is needed. It is intended to be a small part of a holistic, process oriented model of failure mechanisms in shallow forest soils that is a long-range goal of COPE research. However, it is possible that it may also be of some utility as a root strength component in existing slope stability models in order to improve their results.

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Arne Skaugset,
Adaptive COPE

FUNDAMENTAL COPE

MANUAL TREATMENT OF SALMONBERRY OR WHICH BUD'S FOR YOU

Salmonberry development following clearcutting and site preparation can be one of the most difficult vegetation management problems in the Coast Range. Herbicides can provide effective control of salmonberry, but their use is limited on some lands. The effect of slashburning on regrowth is highly variable and depends on fire intensity as well as salmonberry stand and physiological conditions. At best, slashburning retards salmonberry recovery and where salmonberry is present before harvesting, post harvest development can be rapid reducing survival and growth of conifer seedlings and requiring a follow-up treatment. Where use of chemicals is not allowed, manual treatment is the primary option available for reducing or retarding development of this species.

The purpose of manual treatment is obvious—cut back the aboveground growth to provide more light to conifer seedlings and reduce competition for other site resources. The problem is that salmonberry can spring back from manual treatment and that additional treatments may be necessary to release seedlings. The usefulness of this treatment would be greatly improved if a time of cutting related to a stage of phenological development or a method of cutting could be found that significantly retarded regrowth and reduced the need for repeated treatments. The ideal situation would be to find a cutting procedure which is as effective as that found for alder. Finding a weak point in the life-cycle to apply control treatments could also improve the efficiency of chemical treatments. In an effort to find a magic elixir for salmonberry we have initiated studies on some aspects of the basic biology of salmonberry and, on a more applied front, into the response of salmonberry to cutting at different times of the year and to different degrees of manual treatment.

The Salmonberry Rhizome System and Bud Bank

The more basic biological studies are aimed at explaining why salmonberry responds as it does. The hope is to identify weak points (the proverbial Achilles' heel!) in the life cycle that can be exploited to develop different management alternatives. To date we have concentrated on gaining a better understanding of what the beast looks like, what the morphological basis is for its response and what the natural controls are on population growth.

First, it is fairly clear that once the tops are severed the problem becomes one of hoping that the buds which form new shoots are also directly or indirectly affected by cutting. The sum of all the buds on a salmonberry can be referred to as the "bud bank"—as with a bank account the bud bank is dynamic with additions coming in the form of new buds as the stem and rhizome systems expand and subtractions as these buds produce shoots or die. The bud bank can be divided into several "accounts" based on their physical location, susceptibility to damage, age, estimated ability to produce a new shoot and the rate at which the resultant shoot develops.

The most obvious of these "accounts" are those buds on the stump which remain after cutting. These buds appear to have the greatest ability for immediate regrowth. Once they begin to grow they also probably affect the potential of the less active buds by reestablishing apical dominance. The number of these buds remaining is determined by the height of the stump. They are the most susceptible to elimination during logging, burning or manual cutting.

The next group of buds is present on the stem base or root crown at and below the soil surface. These buds have an activity level similar to those present on the stem, but because they are in the cooler soil environment may not react as quickly as do the buds present above ground. In fact, the greater the depth below ground the slower the response. These buds are more protected from disturbance than the buds remaining on the stump and the greater the depth in the soil the greater the degree of protection. It would take a large degree of soil disturbance to eliminate this part of the bud bank.

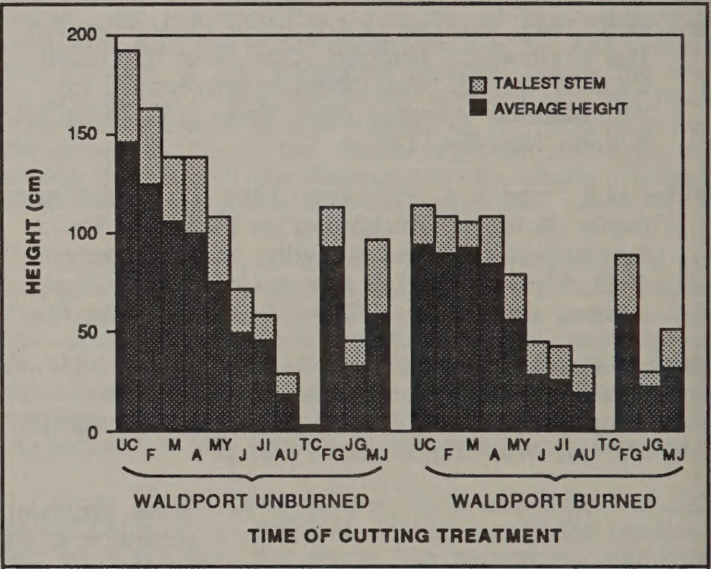
The largest and most complex part of the bud bank is on the rhizome system. Rhizomes are modified stems that grow below ground which have modified leaves and buds similar to the aboveground stem. This system can be extensive and the degree of development is related to the density of the overstory. The extent of this system in terms of biomass or length can be estimated from the overstory basal area or the basal area of the salmonberry stems. In some clearcuts we have found as high as 42 miles of rhizome per acre in pure stands of salmonberry! Although this is the maximum that we have found, normal postharvest stands of salmonberry will have 20 to 30 miles of rhizome per acre. The rhizome system has different bud densities and potential levels of bud activity. Generally it appears that the older, larger diameter rhizomes have fewer living buds and that the buds are slower to develop following disturbance. The young (1- to 2-year-old) rhizomes may have bud densities as high as 1 or 2 per inch and high potential activity levels. These young rhizomes are actively growing, expanding the area occupied by salmonberry and producing new aboveground stems when conditions are right. Rhizomes are usually located within the surface one foot of soil, but we have excavated rhizomes to a depth of 6 feet and have found some that go even deeper. Despite this great potential for shoot production it appears that only a small part of it is ever realized because of various internal and external controls. However the importance of this part of the bud bank cannot be overemphasized with respect to management of this species. This extensive network of belowground stems makes it virtually impossible to eliminate this species from the site as even the most severe soil disturbance or slash fire intensity will only affect a small percentage of the network.

Response of Salmonberry to Manual Treatment

The manual cutting experiment is being conducted on 9 sites (5 burned and 4 unburned) on the Waldport and Hebo Districts of the Siuslaw National Forest. The treatments include cutting at monthly intervals from February to October, 1988 and February, 1989. These treatments are similar to what is done operationally and make no effort to manage the bud bank other than to limit the height of stumps to 8 inches or less. Several other treatments are designed to restrict response to the rhizome portion of the bud bank. In these treatments we have removed the stumps and root crowns leaving the rhizome system intact.

These treatments were imposed in February and July. The most severe treatment used was one in which we removed developing buds and shoots each month in an attempt to determine if the bud bank could be depleted.

Although another growing season's measurements will be necessary to determine the effect of all treatments, the data from the end of the first year provides some information on the response that can be expected. In the accompanying figure (Figure 1) we have presented data on height regrowth on burned and unburned sites on the Waldport District. We are also measuring response in terms of canopy cover and stem density. Salmonberry on these sites was in its first or second growing season after logging or logging and burning. The sites were treated operationally for the first time in 1988.



UC = Uncut (control)
F = February
M = March
A = April
M = May
J = June
JL = July
Au = August
TC = Buds and shoots removed every month (total control)
FG = Stumps and root crowns removed in February
JG = Stumps and root crowns removed in June
MJ = cut in both March and June

Figure 1. Salmonberry height regrowth.

Initial stem height on the study sites was considerably taller on the unburned area. Regrowth on the February to April cuts was rapid and by mid to late summer stems had attained their pretreatment height on the burned site. On the unburned site, stem height did not attain pretreatment levels by the end of the growing season. Cutting from May through October resulted in less growth with each successive treatment date. Whether this reduced growth was simply the result of the limited time available for regrowth or an effect of time of cutting cannot be determined until another growing season has passed.

Differential browsing on these plots has been an interesting sidelight. The treatments which were cut in June and July have had much heavier browsing than those cut before June. Although this complication confounds the response to time of cutting, it does suggest that on some sites the timing of a treatment may result in making the salmonberry more susceptible to other environmental factors that will serve to enhance the treatment effects.

On plots where the stump and root crown were removed, regrowth occurred from buds in the rhizome bud bank only. Initial growth was slower on these plots than it was on the February and June plots which simulated an operational treatment; by the end of the growing season regrowth was less on these plots than on the operational plots.

In the treatment where developing buds and shoots were removed monthly, buds continued to appear through August but in decreasing numbers. At the end of the growing season there were no new shoots in this treatment. It will be interesting to see what the resprouting response is to this maximum level of stress to the bud bank during the 1989 season.

Proactive versus Reactive Salmonberry Management

In all of the situations where manual treatment is currently used we are reacting to regrowth of the salmonberry and other competitors as they become a problem and endanger the survival of Douglas-fir seedlings. This is a logical course of action and results in spending money only in those situations where it is needed to assure survival and establishment of conifer seedlings.

There are situations where it may be possible to treat before the problem arises and thus reduce the need for later treatments. This proactive approach is essentially what is done with slashburning. That is, one common objective of slashburning is to reduce the vigor and rate of development of competing vegetation thus giving planted seedlings a longer competition free period in which to become established.

Based on some exploratory work that we did last summer, we believe that there may be some benefit to treating salmonberry at an even earlier stage, that is, prior to harvesting. In this preliminary study we have observed that salmonberry resprouts poorly under an alder canopy and, furthermore, that the new sprouts are heavily browsed reducing even more the vigor of the response. Further studies of preharvest treatment are needed to determine if this may be a useful treatment on some sites where salmonberry is virtually certain to be a serious problem after harvesting. Cutting of salmonberry in the understory may also be necessary in riparian zones where conifers are to be underplanted.

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John Tappeiner and Bruce Maxwell,
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OF INTEREST

SHELTERWOOD CUTTING FOR HEMLOCK REGENERATION

Forest land managers are facing increasing regulation of traditional reforestation practices in the Oregon Coast Range. Prescribed burning and the use of herbicides to control competing vegetation in particular face legal and/or social constraints. This has changed the reforestation options available to land managers and fostered an interest in techniques that minimize or eliminate the need for burning and herbicide use.

Shelterwood harvest and subsequent management for natural hemlock regeneration is one technique that shows promise as an alternative reforestation method on some sites. Prescribed burning is not necessary with the shelterwood method and herbicide use is likely to be necessary on fewer acres. Initial attempts at regenerating sites in the Oregon Coast Range using shelterwoods have been successful. Economic analyses indicate that there is no loss of income to timber producers using this method as compared to traditional Douglas-fir forestry.

Tom Scoggins, a Unit Forester with the Oregon Department of Forestry in Astoria, has harvested some units along the Columbia River corridor using a shelterwood harvest/regeneration system. The units involved are in airshed sensitive areas (draining toward Portland) on relatively flat (tractor-harvestable) ground, are "adequately" to "well" stocked with at least a 25% component of mistletoe-free western hemlock, and have little or no brush in the understory. Stands were not selected in areas judged to be susceptible to windthrow. Stand characteristics of one of these units before and after the shelterwood cut are presented in Table 1.

On the units harvested so far, about 25-35% of the initial volume and basal area was removed on the first entry. Costs and income related to the shelterwood cut are presented in Table 2.

Western hemlock has seeded abundantly into shelterwood cut areas and is well established in the understory. Current plans are to leave shelterwood areas alone for 4 to 6 years following the initial shelterwood cut. During that time it is expected that the abundant hemlock seedlings present will develop to a height of 1 to 2 feet. Seedlings that are of this size are

Table 1. Stand characteristics of a shelterwood sale area with a site index of 120 (II-), and stand age of 62-67 years.

	Original Stand	Residual Stand
Species Composition:	Hemlock 55%	Hemlock 54%
	Douglas-fir 42%	Douglas-fir 43%
	Spruce 3%	Spruce 3%
BA/Acre	284 ft²	204 ft²
Average DBH:	18.3 in	19.5 in
Average Volume/Acre	57 MBF	42 MBF
Average # Trees/Acre	162	98

Table 2. Timber sale data for a 1986 shelterwood cut on Oregon Department of Forestry land near Astoria, Oregon.

Volume/Acre Removed:	15 MBF
Price/MBF - Douglas-fir:	$218.00
Hemlock:	$215.00
Spruce:	$44.59
Sale Value/Acre:	$3,127.00
Sale Preparation Cost/Acre:	$46.07
Sale Administration Cost/Acre:	$32.42
Total Profit/Acre from Shelterwood Cut:	$3,048.51

flexible and a high percentage of them should survive incidental damage that may occur during final removal of the overstory. When sufficient seedlings of the desired size are present, the overstory will be harvested. Skid trails used in the final overstory removal will be planted with Douglas-fir. As a final step to insure seedling establishment some type of release treatment may be necessary (the Department of Forestry plans to use herbicides). In particular, release may be necessary on skid trail areas where scarification may contribute to establishment of competing vegetation and planted seedlings will not have the "head start" on competitors that seedlings developing under the shelterwood should have.

Economic projections for western hemlock dominated stands established from shelterwood cuts indicate that the internal rate of return (IRR) realized from shelterwoods could be equal to or greater than the IRR realized from traditional Douglas-fir management of the same stands (Table 3).

The true value of shelterwoods may more accurately be measured, however, in terms of the flexibility it gives land managers to solve management problems in the face of increasing constraints. Some key advantages of the shelterwood system include: 1) a reduction in the number of acres to be burned, allowing burning to be concentrated on areas where there are fewer options for successful regeneration, 2) a reduction in the number of acres to be planted, 3) a reduction in the number of acres requiring release (hemlock is more shade tolerant than Douglas-fir making release less critical; western hemlock will also gain a "head start" on brush while in the shelterwood understory), and 4) a reduction in stand establishment expenses. Reforestation cost reductions are projected (Table 4) in the areas of slashburning, fire trailing, seedling cost and planting, tree protection, and plantation maintenance. The cost of precommercial thinning (estimated at $60 to $90/acre) is not included in the cost projection for either system but is likely to be required for both.

Table 3. Douglas-fir/Hemlock Economic Analysis: a comparison of the economic implications of managing for western hemlock instead of Douglas-fir on sites that could support either species.

	Base Silviculture Data	
Future Stand Data	Douglas-fir	Hemlock
Rotation Age	61 years	68 years
DBH	16.6"	16.5"
Volume	54.1 MBF/acre	70.8 MBF/acre
	Economic Data	
Appraised Future Stand Value (1986 dollars)	$4,521/acre	$2,911/acre
Est. Bid Future Stand Value (1986 dollars)	$7,532/acre	$3,726/acre
Est. Bid Future Stand Value (at rotation)	$14,409/acre	$7,376/acre
Internal Rate of Return	5.63%	5.78%

An additional favorable aspect of shelterwood cutting is that current cutting schedules usually do not have to be significantly altered to accommodate a change in harvest method. Most cutting units already scheduled for harvest by the clearcut method could successfully be cut and regenerated using the shelterwood method. Little disruption in the scheduling of harvest of the total stand volume need occur since only 4 to 6 years is necessary for development of a suitable hemlock understory prior to final harvest.

While the stands harvested to date by the shelterwood system in the Astoria District have been on relatively flat ground, current technology in cable yarding could allow for shelterwood harvest on steeper slopes. Moreover, western hemlock seeds prolifically, so it is

Table 4. Comparative costs of clearcut and shelterwood harvesting by management activity.[1]

Activity	Average Cost Per Acre Clearcut (Douglas-fir)	Shelterwood (Hemlock)
Fire Trailing:	$75.00	$0.00
Slashburning:	$155.00	$0.00
Scarification:	$0.00	$10.00
Seedlings and Tree Planting:	$125.00	$38.00
Tree Protection:	$83.00	$27.00
Aerial Spraying:	$72.00	$22.00
Extra Administration Costs for Second Entry into Stand:	N/A	$65.00
Total:	$510.00	$162.00

[1] Costs do not include cost for precommercial thinning (PCT). PCT of dense hemlock stands = $60 to $90/acre. PCT is expected to be necessary under both practices. Prices may vary depending on extent of natural seeding.

expected that stands with western hemlock components of as little as 20 to 25% could be harvested by the shelterwood method and still provide ample hemlock regeneration. Savings in personnel time from decreased administration of planting contracts, fire trailing, seedling protection, and slashburning are likely to be more than sufficient to counter increased administration requirements of a two-cut harvest system.

There are also negative aspects to shelterwood management that land managers must recognize. These include: 1) an increase potential for blowdown; 2) an increased future commitment to precommercial thinning of the second stand because of probable greater tree densities; and 3) the probability that future stands will be predominantly hemlock rather than Douglas-fir. The losses associated with these problems, or new management requirements necessary to resolve them, may be less difficult problems to tackle, however, than continuing to attempt traditional Douglas-fir management in the face of constraints on burning and herbicide use.

Shelterwood harvesting appears to have potential as a method to manage some forest land where constraints would otherwise make management difficult. For more information on the Department of Forestry's experience with shelterwood harvesting, contact Tom Scoggins with the Oregon Department of Forestry, Astoria District, Route 1, Box 950, Astoria, Oregon 97103-9732.

Steve McConnell, Adaptive COPE
Tom Scoggins, Oregon Department of Forestry
Astoria District

OPPORTUNITIES

ADAPTIVE COPE WORKSHOP ON WILDLIFE DIVERSITY AND LANDSCAPE PATTERNS IN NORTHWEST COASTAL FORESTS

September 14-15, 1989. Newport, OR

Land managers are increasingly concerned with strategies to integrate timber and wildlife management in the coastal forests of the Northwest. Current debate centers on the placement of cutting units across the landscape (staggered-setting vs. minimum fragmentation) and leave-tree density and distribution within cutting units. This workshop is designed to facilitate broad discussions among managers and scientists on the trade-offs of various approaches for maintaining wildlife diversity in managed forests. Specific objectives are to:

- Examine present knowledge on wildlife and forest patterns in the Pacific Northwest;
- Review current wildlife/timber management approaches in different northwest landscapes;
- Assess the trade-offs of alternative cutting patterns for wildlife and other resources.

Workshop brochures have been mailed to all COPE cooperators. Contact Andy Hansen, Adaptive COPE, for more information.

CURRENT PERSPECTIVES FOR SILVICULTURAL MANAGEMENT OF RIPARIAN AREAS FOR MULTIPLE RESOURCES

December 1989. Newport, OR

This workshop will discuss the concept of active streamside management for multiple resources. The workshop will begin with an historical overview of fish, wildlife, and riparian area interactions, followed by a session on management of riparian areas for fish and wildlife habitat and water quality. These sessions will focus on identifying the desired vegetation features of riparian areas for each resource and will provide a lead into discussions of the structure and dynamics of riparian vegetation, possible riparian silvicultural systems, and current riparian management approaches. The workshop will conclude with a panel discussion on riparian management: past, present, and future, featuring representatives from public interest groups, timber industry, and state and federal agencies.

The workshop is designed to bring together resource managers with diverse backgrounds and objectives to explore the concept of active management in riparian areas. It is intended for people who are interested in learning how other managers view riparian resources and how riparian areas can be managed for the benefit of multiple resources. For more information, contact Cathie Bacon or Tom McMahon at (503) 867-4011.

ALDER MANAGEMENT WORKSHOP

June 3, 1989. Newport, OR

Red alder is a well-adapted coast forest tree species that can be a nemesis to Douglas-fir reforestation or a resource to be managed and utilized. 'Managing Alder in the Coast Range' will be the subject of a one day workshop presented by the OSU Extension Service on Saturday, June 3 at the Hatfield Marine Science Center in Newport.

OSU faculty Dave Cleaves, Dave Hibbs, and Bill Emmingham will discuss alder marketing, management, and conversion during the morning session. The afternoon program will be held at the alder thinning site on Siletz Reservation lands near Pioneer Mountain. Thinning methods in alder stands, results from growth and yield experiments, and conversion of an alder stand to conifers by underplanting will be discussed. Other in-field sessions will cover vegetation management in clearcuts, wildlife enhancement, and wildlife damage control.

Registration for the workshop will begin at 8:30 am with the program starting at 9:00 am. A $10 fee covers handout materials and lunch. Preregistrations are requested by May 31. Contact Bill Rogers, OSU Extension Service, 29 SE 2nd, Newport, OR, 97365. (503) 265-6611, x 207.

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COPE Report

Coastal Oregon Productivity Enhancement Program

Promoting Integrated Management of Oregon's Coast Range Forests
Through Research and Education

Volume 2, Number 3 Summer 1989

The COPE Program

The Coastal Oregon Productivity Enhancement (COPE) Program is a cooperative effort between Oregon State University's (OSU) College of Forestry, the USDA Forest Service Pacific Northwest Research Station (PNW), the USDI Bureau of Land Management (BLM), other federal and state agencies, forest industry, county governments, and the Oregon Small Woodland Association. The intent of the program is to provide resource managers and the public with information relative to the issues and opportunities associated with the management of fish, timber, water, wildlife, and other resources of the Oregon Coast Range. The COPE Program emphasizes an integrated approach—an integration of research and education and an integration of scientific disciplines—to find effective ways to manage these diverse resources collectively.

The COPE Program has two related components: Fundamental COPE and Adaptive COPE. Comprised of OSU and PNW scientists based primarily in Corvallis, Fundamental COPE addresses problems related to riparian zone management and reforestation in the Coast Range through basic research. Adaptive COPE is comprised of an interdisciplinary team responsible for applying and adapting existing research information to solve specific management problems. Stationed on the coast in Newport at the Hatfield Marine Science Center, the Adaptive COPE team is also responsible for providing continuing education opportunities to facilitate technology transfer.

Published quarterly, the COPE Report provides a means to rapidly disseminate research findings, announce upcoming educational opportunities, and highlight recent publications and topics of interest. Its goal is to foster good resource management by helping people involved in the management of Oregon Coast Range resources to stay well-informed. Comments and suggestions concerning the content of the COPE Report are welcomed and encouraged. To receive this free newsletter, contact COPE, Hatfield Marine Science Center, Oregon State University, Newport, OR 97365. Phone: (503) 867-4011.

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ADAPTIVE COPE

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ADAPTIVE COPE

Large Woody Debris and Fish Habitat in Coast Range Streams

The loss of large woody debris from streams, rivers, and estuaries is potentially one of the most important and long-term impacts of forest management on fisheries resources (Sedell et al. 1988). Over the past decade, information and awareness about the key role that debris plays as fish habitat in streams has increased substantially. As a result, state and federal agencies now require protection of instream debris and retention of standing timber along important fish-bearing streams following harvest to insure a continued source of wood. Also, additions of debris or structures to mimic its function are being used extensively to increase fish habitat in debris-poor systems. However, while the importance of wood as fish habitat is now generally recognized, information about how much wood is in Coast Range streams, the amount and sizes needed, and relationships between debris abundance and fish populations remains incomplete. Last year, we initiated a study to help answer these questions and complement other research efforts.

Synthesis of Existing Data

The first objective of this study is to synthesize current information on abundance and distribution of large woody debris throughout a wide range of Coast Range streams. Over the past several years, a number of independent surveys of wood in streams have been conducted by personnel with the BLM, OSU Department of Fisheries and Wildlife, OSU College of Forestry, and the PNW Research Station. This information on amounts, sizes, and volumes of debris in Coast Range streams is a valuable resource for addressing questions concerning present wood status in streams, and how debris abundance and characteristics vary with such parameters as stream size and management history. Recent reports have summarized the role of debris as fish habitat in coastal streams (Sedell et al. 1988), compared amounts and types of debris in one stream following fire and logging (Andrus et al. 1988) and debris removal (House and Boehne 1987), and examined how debris levels change over time following disturbance (Heimann 1988).

These analyses could be extended considerably by adding unpublished survey information. Over the past several months, we have solicited published and unpublished debris data from researchers and managers throughout the Coast Range area to assemble existing information into a common, computerized database. The response has been very good, and we now have wood information from 90 streams covering over 180 miles of stream length. To add wood information from stream types where data are lacking, we will survey additional streams this summer. We are continuing the search for existing debris information, so if you have any information that could be included in this database, please contact us. Once compiled, the database will be used to compare debris abundance in streams of differing size, order, gradient, and management history. A summary of current debris loading levels in a wide variety of Coast Range streams should prove useful as a 'yardstick' for evaluating changes in debris levels resulting from management activities. Comparisons of amounts and sizes of debris in managed and unmanaged systems should also prove useful for defining streamside management goals for maintaining or increasing appropriate levels and sizes of debris in streams.

Debris and Fish

Previous studies in the Northwest have generally found a close relationship between the quantity of debris in a stream and fish habitat suitability (Bisson et al. 1987). The configuration or 3-dimensional complexity of debris has also been shown to be an important fish habitat feature (Sedell et al. 1988; McMahon and Hartman 1989). Debris provides much of the habitat complexity important for creating the diversity of substrates, current velocities, and cover used as spawning, feeding, and resting sites by salmon and trout.

Many stream miles in the Oregon Coast Range, however, flow through second growth stands logged prior to the current forest practice rules. These streams often are characterized by a dense alder riparian border and a conspicuous lack of large wood. Since debris levels may take 50-120 years or more to reach levels typical of mature forest streams (Heimann 1988), this loss of debris is considered to have a long-term effect on the productivity of salmonid populations. The increase of fish productivity widely observed in streams shortly after streamside logging is due to increased light and temperature levels. However, productivity will probably decrease to low levels in debris-poor streams after canopy closure 20-30 years later.

Various approaches for increasing the fish productivity of debris-poor streams are currently in practice or under study. Two approaches are deliberate additions of wood and manipulation of streamside vegetation to hasten recovery of debris by promoting quicker reestablishment and growth of conifers (see following article). Yet relatively little is known about debris and fish relationships in second growth systems. More detailed information about these relationships are needed to provide the necessary context from which to develop and evaluate appropriate management strategies.

The next step, then, in our study will be to examine large woody debris and fish populations within a second growth watershed. Our sampling design will focus on evaluating debris-fish interactions over an entire basin and over the entire period of freshwater residency of the fish.

Since salmon and trout have differing habitat requirements and utilize different parts of a watershed throughout their time spent in freshwater, past studies have revealed that a broad spatial and temporal scale is needed to obtain a true measure of fish habitat needs and population responses to habitat changes. One of the major aims of COPE fisheries research is to examine stream and riparian systems within a basin-wide context (see COPE Report 1(3):4-6). The importance of a seasonal perspective for determining factors limiting salmonid production has been recognized. For example, the influence of winter conditions on fish survival may equal or exceed that of summer low flow conditions in many streams. In particular, large woody debris appears to be more important as salmonid habitat in winter than in summer (McMahon and Hartman 1989).

A Fundamental COPE study headed by Fred Everest of the PNW Research Station and Jack Sleeper of PNW and OSU entitled "Seasonal habitat use by anadromous salmonids in a pristine coastal basin, and annual smolt production" is currently examining seasonal fish distribution and abundance and large woody debris in Cummins Creek. Cummins Creek, a central coast stream draining directly into the ocean, represents one of the few pristine watersheds in the Coast Range. We will measure and compare the same physical and biological parameters in Cape Creek, a nearby watershed similar to Cummins Creek, which was mostly harvested about 30-40 years ago. With its general lack of large wood and dense canopy of alder, Cape Creek is typical of many second growth streams. It differs from other streams, however, in its relatively high degree of uniformity of harvest throughout the watershed. Most forest streams usually flow through a patchwork of managed and unmanaged sections and thus it is often difficult to examine management effects. Hence, Cape Creek offers a unique opportunity to examine the dynamics of wood and fish populations in a relatively uniform second growth forest, and compare these results to a nearby pristine watershed.

Our survey of Cape Creek also offers the opportunity to examine seasonal fish response to additions of large woody debris. Debris was added to a 1000 meter section of Cape Creek over the past two summers to improve summer and winter habitat (R. Brassfield, District Fish Biologist, Waldport Ranger Station). A basin survey will allow comparison of fish utilization in summer and winter in this manipulated section to other, unmodified parts of the watershed.

Seasonal fish distribution and abundance in Cape Creek will be determined for the entire watershed in summer and again in late winter prior to smolt migration. The latter survey will allow us to compare winter and summer distribution within the watershed, estimate overwinter survival, and estimate smolt output. Recent data from Cummins Creek showed that the abundance of fish determined from a late winter survey corresponded well to subsequent smolt output measured with a smolt trap near the mouth (G. Reeves, unpubl. data). The number of pieces, diameter, and species of debris will also be measured along the entire length of Cape Creek. A complexity index has been developed to rate the suitability of individual debris accumulations as fish habitat. The data on debris, seasonal fish distribution, riparian vegetation, management history, and topography will be put into a GIS package. Data from Cummins Creek is already on a GIS (M. Hemstrom, Willamette National Forest, and J. Sleeper, OSU and PNW). Use of GIS for both watersheds will allow comparison and analysis of spatial differences and similarities in debris and seasonal fish distribution within and between these two watersheds.

Summary

Major research endeavors in the Cope Program are to better define the role of debris as fish habitat in Coast Range streams, and to develop and test various options for effectively managing riparian areas to provide debris to streams over the long-term. Coupled with the above-mentioned studies and the intensive and large-scale surveys of debris and fish in the designated COPE basins of Drift Creek and Elk River currently underway by Bob Beschta, Stan Gregory, Gordy Reeves, Jim Sedell and their students at OSU and PNW, COPE research on active management of riparian areas should provide a wide variety of information useful for addressing the oft-repeated questions: How much wood is enough? What sorts of streamside management practices will insure these desired levels? How effective are deliberate additions of debris to improve fish habitat?

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Tom McMahon and
Ron Rhew, Adaptive COPE

ACTIVE MANAGEMENT TO ESTABLISH CONIFERS IN ALDER-DOMINATED RIPARIAN ZONES

A major goal of the COPE program is to determine the potential for active management in riparian zones to benefit many different resources. Riparian zones in the Oregon Coast Range represent important areas where timber, fish, wildlife, and water most obviously interact. Awareness of this interaction is reflected in the new Oregon Forest Practices Act which has specific regulations for riparian zones designed to protect or enhance fish, wildlife and water resources. Forest practice regulations require leaving a specified number of conifers along streams to ensure recruitment of large woody debris into streams which eventually provide structure for fish habitat. These conifers may also provide a diversity of habitat for wildlife, including large snags. Regulations also allow for some harvest of conifers within the riparian management area, recognizing its potential for timber production.

However, because of past disturbances such as fire and harvesting, many riparian areas are now dominated by red alder, with dense understories of salmonberry and other shrubs. Recent field data gathered by Fundamental COPE scientist Don Minore indicates that there are few conifer or alder seedlings in this type of stand. With few understory conifers, brush species will be dominant following mortality of the alder overstory; conifer establishment in riparian areas and subsequent recruitment in streams will be delayed. In the interim, such brush stands would provide no woody debris, snags, or timber to riparian areas. An active management approach could be used to shorten the establishment time of conifers, thereby providing management systems that concurrently benefit fisheries, wildlife, timber and water resources.

STUDY DESCRIPTION

The first in a series of studies designed to investigate active riparian management will evaluate ways of establishing and growing conifers in alder and brush dominated riparian zones. The idea to plant conifer seedlings along streams is not new. Resource managers with the National Forests and Bureau of Land Management have underplanted conifer seedlings, usually redcedar, in riparian zones for a number of years. But, these plantings have rarely been monitored, nor have they involved manipulation of existing vegetation. This COPE study will take a rigorous experimental approach and will include manipulation of both the existing overstory and understory vegetation to find a method that allows rapid establishment and growth of planted conifer seedlings.

Six study sites have tentatively been selected on federal, state, and private lands ranging from Astoria to Gold Beach. Vegetation manipulations will begin this summer and will include two understory treatments superimposed on three overstory treatments (Figure 1). In order to cover a range of possibilities, alder treatments will include 1) girdling all trees, 2) girdling half of the trees, or 3) leaving the canopy intact. The understory will be removed from half of each overstory treatment plot. Douglas-fir, grand fir, western redcedar, and western hemlock seedlings will be planted in each treatment late next winter. Half of the seedlings will be protected against animal damage with plastic-mesh flexible tubing. Seedlings will be measured each year for the duration of the COPE Program.

This is the first of many active riparian management studies planned by the Adaptive COPE team. Two more studies in this group—"Evaluating Thinning of Alder to Release Understory Conifers" and "Woody Debris Piece Size in Small Streams"— will start next year and will be highlighted in future issues of the

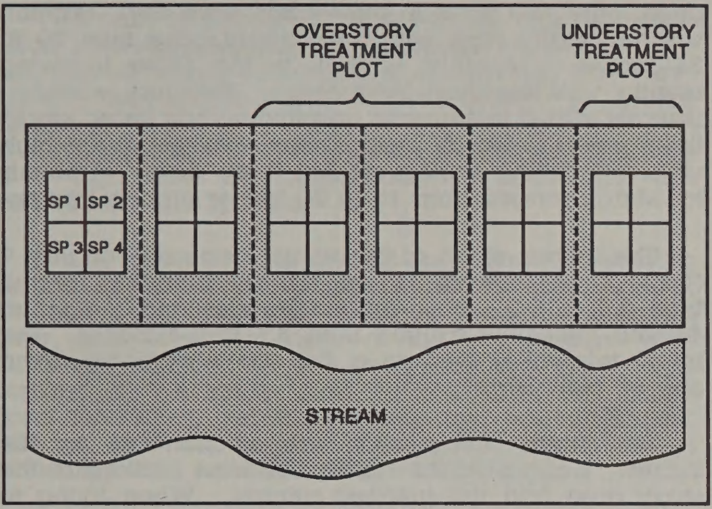

Figure 1. Proposed plot layout showing the two understory treatment plots within the three overstory treatment plots for a total of six treatments. Four conifer species (SP1-SP4) will be planted in each treatment and half of the seedlings will be protected from browsing with tubing.

COPE Report. Results from these studies will be synthesized toward the end of the COPE Program to develop and evaluate various approaches to active riparian zone management.

Cathie Bacon, Adaptive COPE

UPCOMING COPE WORKSHOP: WILDLIFE DIVERSITY AND LANDSCAPE PATTERNS IN NORTHWEST COASTAL FORESTS:

September 14-15, 1989

Foresters and wildlife biologists make tough decisions every day that influence both wood production and wildlife habitats. Where will new harvest units be placed? How many snags and leave trees will be retained? What site preparation techniques will be used? At what ages will the plantation be thinned and harvested? All of these decisions relate to forest production rates and associated economic costs. They also strongly affect the diversity and abundance of wildlife that can inhabit managed forests.

Presently, new silvicultural strategies for integrating timber and wildlife management are being developed and, in some cases, implemented. At the stand level, the maintenance of large green trees, snags, and downed logs over the rotation cycle is receiving much attention. At the landscape level, efforts are being made to minimize forest fragmentation. The resource and economic trade-offs of these approaches have not yet been fully evaluated. Hence, it is difficult for land managers to choose between different management options.

On September 14 and 15, the COPE Program will present a workshop in Newport on "Wildlife Diversity and Landscape Patterns in Northwest Coastal Forests". The goal of the workshop is to bring together scientists and managers to examine strategies for maintaining wildlife diversity in managed forests and to identify the associated trade-offs. Information provided should help forest managers in making the hard choices between the various management options available to them.

The two-day workshop will consist of several presentations by scientists and managers punctuated by discussion periods. The conceptual background for the workshop will be established in the introductory talks. These presentations will provide overviews of the challenges and opportunities for integrating timber and wildlife management, the legal, economic, and ethical incentives for managing biodiversity in northwest forests, and applications from the emerging field of landscape ecology.

The second session will review what we know about habitat patterns in the region and how wildlife responds to these patterns. Starting at the stand level and progressing to region-wide perspectives, these presentations will synthesize diverse studies from both managed and unmanaged forests.

Case studies on the management of various private, state, and federal lands will be featured in the third session, giving an overview of the array of wildlife/timber management practices common in the region. Five land managers will explain the strategies they use, how well the strategies work, and the new approaches they are considering.

The fourth session will attempt to break new ground in evaluating the resource trade-offs of current and new silvicultural strategies. First, the rationale underlying staggered-setting, minimum fragmentation, and long-rotation cutting patterns will be presented. Then, the management of forest structure and composition within plantations will be considered. Subsequent speakers will then evaluate the consequences of these different strategies relative to wood production, wildlife diversity, hydrology, and fisheries.

The workshop will conclude with a panel discussion between representatives from agencies, private industry, and environmental groups. Key questions will include: How are present forest practices influencing wildlife diversity? What are the resource trade-offs of current and alternative strategies? What are the different motives, constraints, and responsibilities on private verses public lands relative to maintaining wildlife diversity? What key research and management questions loom in the future?

This workshop will not endeavor to produce guidelines for management, but rather, foresters and wildlife biologists will leave the workshop with concepts and knowledge useful for making the management decisions they face every day. For more information on the workshop, contact Marcy Berg at (503) 867-4011.

Andy Hansen, Adaptive COPE

FUNDAMENTAL COPE

SUMMARY OF PRECIPITATION DATA FOR THE FIRST HALF OF THE 1989 WATER YEAR

The following is a summary of data collected by nine recording rain gauges located in the central Coast Range (Figure 1). The recording gauges were installed in September of 1988 (COPE Report 2(1):6) to fill an information gap that existed concerning storm intensity and its effects on slope stability and landslide frequency (COPE Report 1(1):6-8). Seven storage gauges were also set out during the winter to verify amounts collected by recording gauges and help check for elevational differences in rainfall.

The 1989 water year began dry with most gauges recording less than an inch of rain in October (Table 1). Winter rains began on November 1 with a vengeance; only two days in November were dry. Rainfall was unusually high with amounts ranging from 20 to 36 inches. Monthly rainfall in the three following months was less than November's. February was particularly dry due to arctic conditions that lasted about three weeks. March precipitation was unusually high with rain falling during all but three days. Amounts for March ranged from 15 to 25 inches among gauges.

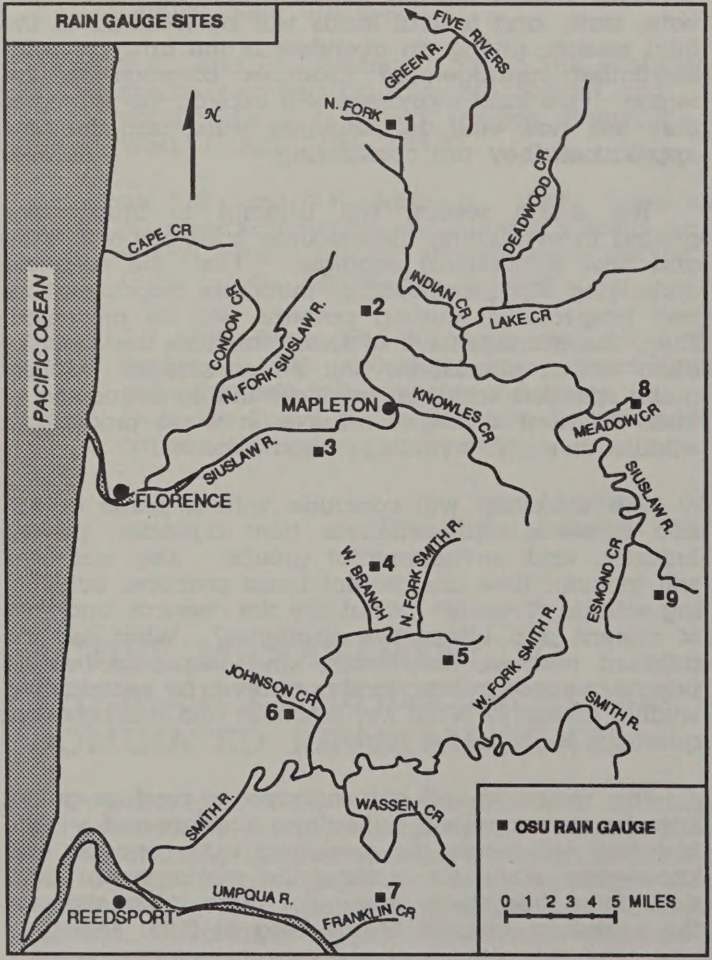

Figure 1. Locations for central Coast Range rain gauges.

The largest storm of the winter occurred January 9 (Table 2). Maximum 24-hour rainfall intensities ranged from 2.4 to 5.0 inches among gauges and maximum 48-hour intensities ranged from 3.7 to 8.4 inches. The return interval of a storm of this size is probably about one or two years.

Six month precipitation ranged from 56 to 104 inches. Gauges in the north and west portions of the study area had the greatest rainfall. When trying to predict six-month rainfall using distance from the ocean, distance north from the Umpqua River, and elevation, only the first two variables proved significant ($p<0.05$). However, these two variables only explained about 50% of the natural (observed) variation in precipitation.

Table 1. Monthly precipitation for first half of 1989 water year

Gauge	Elev. (ft)	Dist. From Ocean (mi)	Dist. North[1] (mi)	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
				Precipitation (inches						
1	1040	13	38	1.5	36.2	13.7	18.7	8.8	25.1	104.0
2	780	12	30	1.0	23.8	10.7	14.1	8.9	19.6	78.1
3	1040	11	23	0.9	24.9	9.5	12.0	7.0	20.4	74.6
4	1640	14	18	1.1	28.2	12.3	18.1	8.2	23.8	91.7
5	1220	18	14	0.3	20.3	7.9[2]	10.6[2]	5.7	15.6	60.4
6	760	11	11	0.7	20.1	8.5	12.0	6.6	18.6	66.4
7	1400	16	3	0.5	20.8	8.0	10.3	4.7	16.2	60.6
8	1400	25	26	0.5	19.6	7.6	8.9	4.2	14.7	55.6
9	1000	27	17	0.4	20.0	7.8	10.3	4.8	14.7	58.0

[1] Miles north of Umpqua River at the Wells Creek Guard Station
[2] Values extrapolated from nearby gauges

Table 2. Precipitation intensity for the three largest storms recorded in rain gauges in the central Coast Range region.

	Jan. 9 Storm		Nov. 21 Storm		Feb. 16 Storm	
Gauge	24h max.[1]	48h max.[2]	24h max.	48h max.	24h max.	48h max.
1	4.2	6.0	3.6	6.7	3.7	4.6
2	3.5	4.2	2.0	3.4	3.1	3.8
3	2.4	4.3	M	M	2.5	3.2
4	5.0	8.4	2.7	4.7	3.8	4.4
5	M	M	2.5	3.7	2.3	2.8
6	2.8	4.4	2.1	3.2	2.7	3.1
7	3.4	4.8	2.1	3.4	1.6	1.7
8	2.9	3.8	1.9	3.4	1.6	2.0
9	2.5	3.7	2.8	4.1	2.2	2.5

[1]Maximum rainfall within 24-hour period (inches)
[2]Maximum rainfall within 48-hour period (inches)

Two pairs of storage gauges verified that the correlation between elevation and rainfall was weak. One pair placed within two miles of each other, but varying 900 feet in elevation, showed only a 8 percent difference in rainfall. Another pair differing 660 feet in elevation showed a 10 percent difference. The lack of a significant correlation between elevation and rainfall was unexpected.

When mean 24-hour and 48-hour rainfall intensities for the seven largest storms were regressed against distance from the coast, distance from the Umpqua River, and elevation, none of the independent variables was significant. The gauge network shows that portions of the study area have consistently higher storm intensities, yet the patterns are not systematic. Perhaps, local topography plays an important role in funnelling and enhancing storm rainfall.

Detailed information on this rain gauge data can be obtained from Chip Andrus at the Forest Engineering Dept., Oregon State University (737-2380).

Chip Andrus
OSU Forest Engineering Department

DURATION OF SITE PREPARATION EFFECTS

Much practical experience, as well as several research studies, has demonstrated that site preparation improves reforestation success in the Coast Range. Conifer survival and growth are generally greater on areas broadcast burned or treated with herbicides than on areas given no site preparation. However, questions naturally arise when viewing such results: (1) How much do the early gains obtained from these site preparation practices speed growth or increase the yield of the harvestable crop, and (2) Are the gains sufficient to offset the added costs of producing them? Two studies that show such early gains are being continued as one COPE project to determine the effects of site preparation during the second decade of stand development.

Site Preparation Methods Compared

Site preparation methods have been compared on an operational scale in two long-term studies conducted cooperatively by the Siuslaw National Forest and the Pacific Northwest Research Station, USDA Forest Service. Four site preparation options have been compared side-by-side in one study and six in the other. In both studies, conifer survival and growth and the development of competing vegetation have been observed for more than 8 years, but the studies differ in design and complexity.

The Coastal Reforestation Systems study involves four site preparation treatments, seven classes of tubed and untubed nursery stock, and a release and no release treatment, all replicated on clearcuts located from north of Hebo to southeast of Florence. The site preparation methods being compared, each on one-fourth of a clearcut, are: no preparation, aerial spraying of herbicide, broadcast burning, and aerial spraying followed by broadcast burning. Survival and total height has been observed at scheduled intervals on rows of trees of all stock classes planted in large blocks at 9- x 9- or 10- x 10-foot spacing. Vegetation development has been measured on 50-foot transect lines and on milacre plots that sample all treatments. Six complete replications were installed, one or two each year. Tenth-year tree measurements, completed in the spring of 1989, marked completion of field work as originally scheduled.

The Coastal Site Preparation study involves side-by-side comparisons of site preparation treatments on adjacent 5-acre blocks in each of four clearcuts. The site preparation methods being compared are: no preparation, manually clear a 4-foot radius at each planting spot, aerial spray with glyphosate, broadcast burn, manually slash woody vegetation and broadcast burn, or aerial spray with picloram and 2, 4-D and broadcast burn. Trees were planted at 10- x 10-foot spacing; widely spaced rows of trees were designated for initial and periodic remeasurement of total height and stem diameter. Every other tree was protected from animals with plastic mesh tubing. Vegetation development has been measured at each planting spot on a short line transect. The entire study was installed in 1980 and tenth-year measurements will be made in the summer and fall of 1990.

Comprehensive summaries and analyses of data already obtained from these studies are now being made. Highlights will appear in future issues of the COPE Report.

Combined Effects of Site Preparation and Density

When site preparation improves survival and tree growth, tree crowns close more quickly, and competing vegetation is overtopped and shaded out sooner. But intense competition between trees also begins more quickly. How site preparation and stand density effects interact in stand and vegetation development will be determined by continuing the site preparation comparisons at two stand density levels.

Because of differences in design, the studies must be continued separately, but both will contribute answers to these questions:

1. Do the differences in tree survival and growth evident among site preparation treatments at 10 years narrow or widen as the stands develop during the second decade?
2. How much does a difference in stand density alter the effects of the site preparation treatments?
3. How does coverage and composition of vegetation change as tree crowns close?

4. How much is this vegetation change slowed in a less dense stand?

5. What differences in wildlife use are evident at different stand densities?

The relationship between growth of individual trees and associated vegetation will continue to be measured in the Coastal Site Preparation study.

Continuation of the studies into the second decade requires the establishment of growth plots in all site preparation treatments, and thinning half the plots to roughly 14- x 14-foot spacing—about 225 trees per acre. A low density was chosen to ensure good contrast with unthinned plots that may have a density of 300 to 450 trees per acre. Improving uniformity of spacing while retaining the best crop trees is the primary criterion to be followed in thinning.

Growth plot layout, thinning, and baseline measurements were completed on Pitchfork, the oldest replication of the Coastal Reforestation study in June of 1989. Pitchfork, located in the Alsea drainage several miles west of the Denzer Bridge, is on a moderately steep south slope (Figure 1). Trees have grown rapidly; in some treatments, crowns of 13-year-old trees have already closed enough to shade out all understory vegetation. All replications of the study are scheduled for thinning when trees are 13 years old. Baseline measurements of vegetation will be made on the next two replications, Beaver and Upperten, this summer; growth plots and thinning will follow next winter or spring.

Growth and vegetation plots will be remeasured every 3 years. Interim results on these site preparation comparisons will appear in future issues of the COPE Report.

William Stein, PNW

OF INTEREST

GEOGRAPHIC INFORMATION SYSTEMS: PRACTICAL PREDICTION OF PATTERNS AND PROCESSES OR PERPETUAL PROLIFERATION OF PROBLEMS?

General Concepts

Geographic Information Systems (GIS) consist of a database containing some form of spatial coding that allows data to be manipulated (stored, retrieved, combined, displayed) with reference to a specific (and hopefully correct) location. Generally, these systems include some method for outputting screen and/or hard copy images of data. These systems have been around in some form or another since the early to mid 70's and have continued to evolve and flourish with recent advances in computer technology. Particular features of a GIS, along with the nature and quality of input data, define resulting information quality and reasonable use of GIS to answer spatial questions.

In general, there are two types of data structures used in GIS, grid (raster) and polygonal (vector). A grid based system uses square cells of a pre-defined size for coding of data values. These cells may be arranged in square or rectangular configurations. All maps within the database have or are converted to a single configuration. The advantage of the grid data

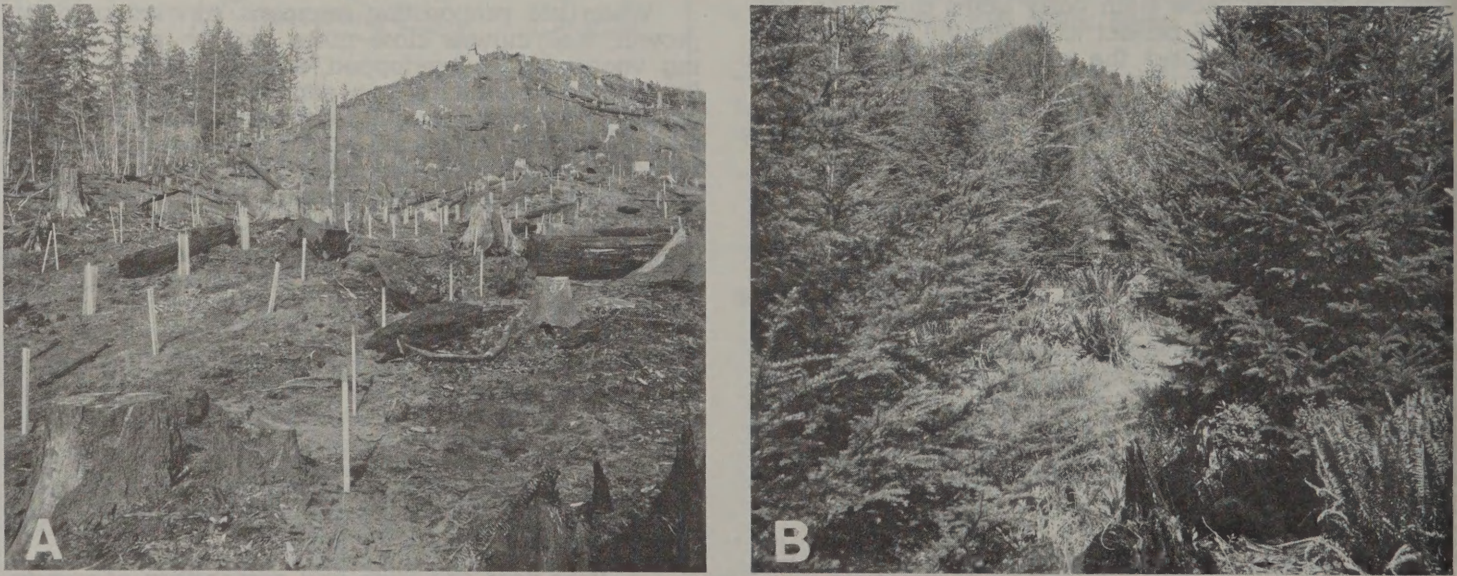

Figure 1. Appearance of the broadcast burned area on Pitchfork (A) in 1976 after planting and (B) in May 1987. The foreground opening that provides a view resulted from an unplanted spot.

structure is the relative ease of analytical operations due to a one-to-one spatial correspondence of data cells between map layers. This process would be equivalent to pressing a pin through several sheets of (aligned) graph paper, with each sheet of paper representing a map layer or theme. Some disadvantages include:

1) Inability to change scale or zoom-in on map data
2) Fixed storage size of map layers (regardless of the complexity of information contained within a map, each cell must contain a value, although newer data structures like the quad-tree are alleviating this problem)
3) A blocky or bit-mapped appearance of displayed material. Data boundaries are not portrayed as smooth lines.

Polygonal (vector) systems maintain data in the form of coded line segments. Two point or vector codes are adequate for simple lines, while triangles, polygons, and curves require additional coding. Storage size of data layers may be variable, dependent on the complexity of the map theme. Analytically, the assignment of proper categories when performing map operations ranges from simple (for single or multiple non-overlapping polygons) to complex (multiple overlapping polygons). Simple addition of complex map layers requires multiple integration of newly defined areas.

Some systems may use raster/polygonal combinations (switching to raster for analytical operations) or allow for conversion from one type of data structure to the other For example, MOSS a public domain GIS used and developed by Federal agencies can use either raster or polygonal data.

Polygonal systems were developed in an attempt to automate cartography, while grid cell or raster systems have been developed as a spin-off of spatial and image analysis (Burrough 1986) It's convenient to note here that regardless of the type of system that you use, the product image is converted to raster format for display on the computer CRT. Additionally, at a scale of 1:500,000 (1.0 inch = 8.0 miles) a 0.5 mm pencil line would be 277 yards wide; a single dot would cover 76,729 square yards! The point being accuracy or resolution is not defined by the smoothness or neat appearance of the map (although neat tidy maps are visually more appealing).

The phrase "garbage in, garbage out" is especially pertinent to the use of and interpretation of GIS supplied information. The bottom line is you must know the accurate location of a data point. Grid systems may be a little more forgiving (you must know if you are located in a particular cell) but as potential resolving power increases concurrent with hardware development, the distinction fades. Furthermore, the presence of inaccuracies (especially in basic map layers) serves to compound errors when inaccurate data layers are used in analysis. The resolution of the system, the predictive accuracy of the analysis, can never exceed that of the input data. With respect to source material for GIS input, it is necessary to know the assumptions and limitations of methods and techniques used for data acquisition. For example, soil types are delineated with continuous lines in survey materials, although actual patterns do not reflect such discreet boundaries. Similar situations exist with vegetation, rainfall, temperature, stream channel locations and many other features. Related to this is the gamut of processes and attributes that may occupy discreet boundaries within a landscape at a given point in time but whose boundary may change with time. A good example of such temporal boundaries is reflected by changing landuse patterns in agricultural areas, where seasonal change in crop rotations is a certainty.

Digital Information for Oregon

Oregon's State Map Advisory Council (established in 1977) has been designated as the lead state organization for the development and coordination of GIS programs within the state, and development and documentation of Oregon digital materials (Oregon Cursor 1988b). The United States Geological Survey (USGS) is continuing efforts to convert topographic information to digital format. Digital elevation models are available at several accuracies and scales from:

Western Mapping Center-NCIC
U.S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025
415-329-4309/FTS 459-4309

A quarterly newsletter, the Oregon Cursor, provides interagency information on GIS related topics on a regular basis. This newsletter is provided free of charge by the Oregon Water Resources Department, and may be requested by phone at 503-378-3617, or by mail from:

Oregon Water Resources Department
3850 Portland Road. NE
Salem, OR 97310.

Implementation

Geographic information systems are powerful tools for the storage, retrieval, and analysis of spatial data. Data analysis between and among different data sets, or overlay analysis, represents an important capability in making a GIS work for you. A few examples of GIS implementations are presented to illustrate this point.

Dr. Bill Ripple at OSU is leading a project funded by NASA which will use LandSat data to identify landscape features for input to a GIS. Features of interest to this project include successional stage, distribution and connectedness of patches, and amount of edge and interior habitat. Digital techniques for these tasks will be developed by this research group on study sites in the Oregon Coast Range and in the Oregon Cascades. These data will be loaded into a GIS containing ground based survey data about various wildlife species. Results from statistical correlations between landscape structure and species occurrence obtained in overlay analyses could then be used as input for forest management decisions affecting forest patterns.

According to Lisa Blackburn (GIS Section Chief, Bureau of Land Management, Portland) the BLM is nearing completion of its digital database, and will soon be ready to implement the use of GIS. BLM district offices will be using MOSS software on Data General or Prime mini computers. Digital data is being compiled at a scale of 1:4800 over an area of approximately 7,000,000 acres at a cost of approximately $0.90 per acre. Once complete, this data will be used operationally on a daily basis to aid in land management decisions.

The U.S Forest Service will be implementing GIS by 1991, using a variety of hardware and software. Oregon Forest Service offices are in various stages of implementation (Oregon Cursor 1988a). The Pacific Northwest Research Station in Corvallis has already purchased Pmap, and will shortly have access to both MOSS and ARC-INFO systems.

Jack Sleeper (OSU) and Miles Hemstrom (USFS) are currently using PC-ARC-INFO to look at fish/watershed interactions in a coastal watershed (see previous article on page 2). Within the COPE program, plans are underway for using GIS as a tool for integrating and analyzing basin level data, and for a landscape level analysis of wildlife habitat.

Closing Comments

So what good is a GIS? Does the relatively high potential for inaccuracy and the more basic conflict of false accuracy implied by data portrayal prohibit their use? No, as long as the assumptions and expectations of GIS generated information are in-line, held in check by knowledge of the limiting assumptions of data acquisition, there is no limit to their useful application. Perhaps a basic rule of thumb should be to use GIS as a filter to develop or suggest alternatives that may then be field checked by technical experts for accuracy.

In addition to GIS, other types of methods and equipment for spatial analysis exist that may be used separately or in conjunction with a GIS. The following list of references provides a brief introduction to these methods

Getis, A., and J. Franklin. 1987. Second-order neighborhood analysis of mapped point patterns. Ecology 68(3): 473-477.

Journel, A.G., and CH.J. Huijbregts. 1978. Mining Geostatistics. Academic Press Inc., New York, NY. 600 p.

Krummel, J.R., R.H. Gardner, G. Sugihara, R.V. O'Neill and P.R. Coleman. 1987. Landscape patterns in a disturbed environment. Oikos 48(3): 321-324.

MacDonald, G.M., and N.M. Waters. 1988. The use of most predictable surfaces for the classification and mapping of taxon assemblages. Vegetation 74: 125-135.

McDaniel, T.W., C.T. Hunsaker, and J.J. Beauchamp. 1987. Determining regional water quality patterns and their ecological relationships. Environmental Management 11(4): 507-518.

Paine, D., and J. Kiser. 1988. Vegetation mapping and inventory of coastal riparian zones. Cope Report 1(1):8-9.

Robertson, G.P. 1987. Geostatistics in ecology: interpolating with known variance. Ecology 68(3): 744-748.

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Anonymous. 1988a. U.S. forest service gears up for GIS. The Oregon Cursor 3(3):3.

————1988b. SMAC charts state agency GIS course. The Oregon Cursor, 3(3):2.

Burrough, P.A. 1986. Principles of Geographic Information Systems for Land Resource Assessment. Oxford Univ. Press, New York, NY. 194 p.

Ron Rhew and John Donahue,
Adaptive COPE.

OPPORTUNITIES

GIS TECHNOLOGY IN LAND AND RESOURCE MANAGEMENT — Advanced Session Aug. 21-25, Introductory Session Sept. 14-15, 1989 Corvallis, OR

The growing use of computers in land and resources management is profoundly changing data collection procedures, analytical processes and even the decision-making environment itself. The emerging technology of Geographic Information Systems (GIS) promises a similar revolution for research, planning and land management. GIS technology has matured to the point where it is routinely used by all types of land and resource agencies. GIS offers new opportunities for reducing costs, a substantial attraction in the current environment of tight budgets.

The introductory course is designed for planners and resource managers who have had minimal exposure to GIS, but anticipate using the technology or interacting with GIS specialists. There are no prerequisites for this workshop, but basic familiarity with office computers is recommended. The advanced workshop is aimed at experienced GIS users or persons who have completed an introductory GIS course. This workshop offers advanced study into the analytic and modeling capabilities of GIS. For further information contact the

Conference Assistant, College of Forestry, OSU, Peavy Hall, Room 202, Corvallis, OR 97331-5707 or phone (503) 737-2329.

IMPLEMENTING TECHNIQUES FOR SUCCESSFUL FOREST OPERATIONS— COUNCIL ON FOREST ENGINEERING ANNUAL MEETING

Aug. 27-30, 1989 Coeur d'Alene, ID

This meeting will consist of technical sessions and a one day field trip to visit active operations in the area. Topics of the meeting include: mechanization; cable yarding systems; ground skidding systems; and transportation. The meeting is co-sponsored by Forest Engineering Inc. of Corvallis, OR and the University of Idaho and will be held at the Coeur d'Alene Resort. For more information contact Stephen Aulerich at Forest Engineering Inc., 620 SW 4th St., Corvallis, OR, (503) 754-7558.

FORESTRY ON THE FRONTIER — SOCIETY OF AMERICAN FORESTERS NATIONAL CONVENTION

Sept. 24-27, 1989 Spokane, WA

This four-day meeting will feature general sessions on Resource Sustainability Issues, including global warming and biodiversity; Emerging Technologies such as biotechnology, information management systems, and conflict resolution; and Preparing for the New Frontier, which will discuss international markets, demographics, and how to adapt to change. There will also be many working group technical sessions dealing with diverse topics from economics and policy to wilderness management to urban forestry. Of particular interest will be sessions entitled "Forest Management and Riparian Areas," and "Wildlife, Fish, Forestry: Partnerships into the Future." Several technical field trips and organized leisure activities are also offered. For more information contact Richard Reid, Society of American Foresters, 5400 Grosvenor Lane, Bethesda, MD 20814-2198 (301) 897-8720.

RECENT PUBLICATIONS

PROCEEDINGS OF THE WORKSHOP: APPLYING 15 YEARS OF CARNATION CREEK RESULTS by T.W. Chamberlin, Ed. 1988. Pacific Biological Station, Nanaimo, B.C.

Two long-term studies have provided much of our basic knowledge and awareness of fisheries-forestry interactions: The Alsea Watershed Project in Oregon and the Carnation Creek Fish-Forestry Project in British Columbia. This workshop proceedings summarizes 15 years of results on the physical and biological changes that have occurred in the Carnation Creek watershed after clearcut logging. Seventeen papers dealing with subjects such as hydrology, channel morphology, sediment, temperature, stream invertebrates, winter ecology, estuarine habitat utilization, and summaries of population responses to logging by chum and coho salmon, and steelhead and cutthroat trout are also included.

Transcripts of the question and answer sessions and panel discussions following each session provide an interesting mix of perspectives from scientists, managers, and policymakers on the interpretations, implications, and applications of study results. Also included is a provocative paper on institutional voids in technology transfer between researchers and managers. A useful companion document to the proceedings is the recently published annotated bibliography of the 147 articles and papers developed from the project (An Annotated Bibliography of the Carnation Creek Fish - Forestry Project - 1970 to 1988 by V.A. Poulin and J.C. Scrivener. 1988. Can. Tech. Rept. Fish. Aquat. Sci. 1640. 35 p.). Both publications are available from C. Scrivener, Pacific Biological Station, Nanaimo, B.C. V9R 5K6.

TM

FROM THE FOREST TO THE SEA: A STORY OF FALLEN TREES by C. Maser, R.F. Tarrant, J.M. Trappe and J.F. Franklin, Technical Editors. 1988. USDA Forest Service, Pacific Northwest Research Station, General Technical Report PNW-GTR-229. 153 p.

Trees, even after they die, represent an important forest resource. While standing, dead trees provide foraging and nesting sites for wildlife. After falling to the forest floor, logs contribute nutrients and structure to the soil. Even after reaching streams, and eventually the sea, woody debris maintains nutrient cycles and habitats for fish and other aquatic and marine organisms. This book synthesizes current knowledge on the role of woody debris in forest ecosystems in a straightforward and readable fashion. It examines woody debris abundance and influence on ecological functioning in forest, stream, and estuary systems. Moreover, the book identifies key topics for future research. Land managers and scientists will find this to be a valuable source book for information on the importance and management of dead trees. This publication is available through the USDA Forest Service Pacific Northwest Research Station, Corvallis, OR 97331.

AH

WOODY DEBRIS AND ITS CONTRIBUTION TO POOL FORMATION IN A COASTAL STREAM 50 YEARS AFTER LOGGING by C.W. Andrus, B.A. Long, and H.A. Froehlich. 1988. Can. J. Fish. Aquat. Sci. 45:2080-2086. Supplies of woody debris available to stream channels can be reduced by short harvest rotations combined with high wood utilization. Because such reductions can adversely affect streams and associated fish populations, current forest practice regulations in Oregon require that riparian zones of logged watersheds be maintained to provide both shade and woody debris to streams. This study addressed the question of how much and what type of debris is produced by young riparian stands and the amounts of wood delivered to a 4th-order coastal Oregon stream 50 years after logging and fire. The authors found that debris from the current stand represented only 14% of the total debris volume and 7% of the debris volume responsible for pool formation. 'New' debris was about half the diameter of debris originating from the previous stand (24 vs. 45 cm), and the size of pools formed by new debris was roughly half that of pools created by 'old' debris. Composition of the current riparian forest stand varied with topography: moist terrace sites were dominated by alder, whereas a mixture of alder and conifers occurred on slopes. Study results indicated that riparian trees must be left to grow longer than 50 years to ensure an adequate, long-term supply of instream debris. Debris from previous stands plays a crucial role in the interim and should not be removed from stream channels. The authors also found that sections along the stream lack the minimum of 22 conifers/ha prescribed by forest practice rules, and suggested that planting conifers within riparian areas may be needed in some areas to ensure conifer debris recruitment to streams.

TM

BLACK BEARS PREFER UREA-FERTILIZED TREES by E.E. Nelson. 1989. West. J. Appl. For. 4(1):13-15. Black bears interfere with reforestation by girdling trees on thousands of hectares of land in western Oregon and Washington. This girdling can be complete, causing mortality, or partial, resulting in wounds that may become entry courts for decay fungi. It has often been observed, but not experimentally verified, that bears tend to attack more vigorous trees on more productive sites. This study tested the hypothesis of preferential damage to more vigorous trees using fertilized and unfertilized plots of an established root disease study. Before fertilization there was no bear damage evident but three years after treatment there was significant damage. More than four times more mortality occurred on fertilized plots than on untreated plots over the ten year observation period. Only Douglas-fir trees were killed and the other tree species (hemlock and redcedar) were ignored. Nearly all of the trees killed were between 13 and 23 cm (5 and 9 in) dbh. These results confirm that the trees most susceptible to bear damage are the most vigorous and fast-growing ones. This paper is available from the Pacific Northwest Research Station, Corvallis, OR 97331.

CB

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SLOPE STABILITY LABORATORY
NOVEMBER 21, 1989

Welcome to the Newport Slope Stability Laboratory. All of the equipment being demonstrated today is dedicated to calibrating the analytical model of root reinforcement, described in the *COPE Report* Vol. 2 No. 2. The purpose of the apparatus is to produce stress-controlled soil failures under a continuum of simulated root biomasses. Today's demonstration will give you an introduction to the laboratory procedures. Following is a brief description of each piece of equipment and its function.

The room is dominated by the tilting table which is a bin, hinged at one end and activated by a winch, drum, and cable at the other. An experimental run consists of filling this bin with sand at a uniform density to a predetermined height using the white drop spreader and conveyor (stored along the south wall), and then tipping the table. A Hewlett-Packard 9816 with data acquisition board monitors a Celesco PT-101 string potentiometer which is calibrated to indicate table slope. Surface deformation is recorded using a microcomputer frame grabber. A Pulnix TM 440, RS-170 standard TV camera is mounted rigidly above the table (the TM 745 high resolution camera mounted on the table today is being tested on consignment from Motion Analysis, Inc. of Eugene). The TV signal is digitized by a Coreco OC-300 frame capture board installed in a Legend Technology 16MHZ AT compatible microcomputer. Full frames are digitized into 512x483, 8 bit image files every 1/30 of a second. Software developed at the laboratory using a high level, C language library supplied by Coreco, performs the following tasks: Near-real-time motion analysis to trigger image capture; target detection, location, and ranging, on archived images; and three dimensional target positioning by affine image transformation and target radius/range function. Surface deformation is inferred from target positions tracked through successive images.

The laboratory will be fully operational for zero fiber runs before year's end. Identification and materials testing of potential simulated roots, materials testing of the sand, and software development for implementing the analytical model are a few of the tasks to be accomplished in the near future. Production runs of the tilting table will soon be on a regular schedule.

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